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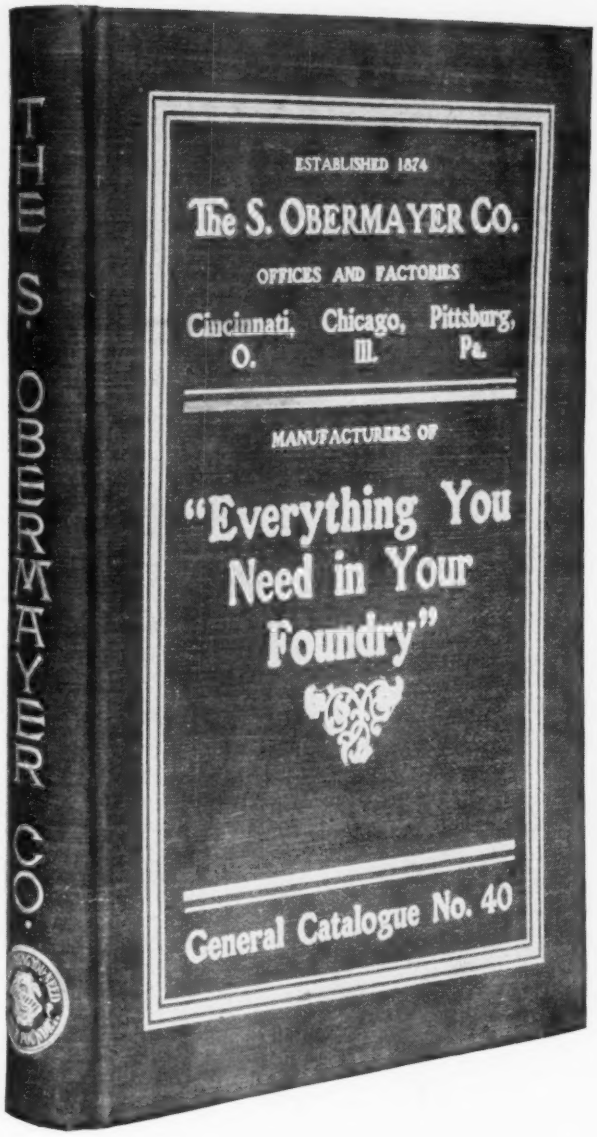
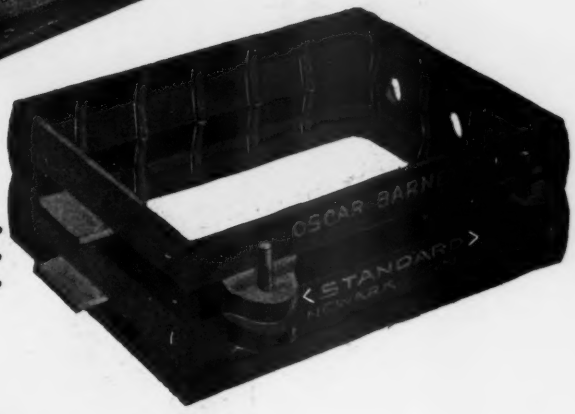


The S. Obermayer Co.

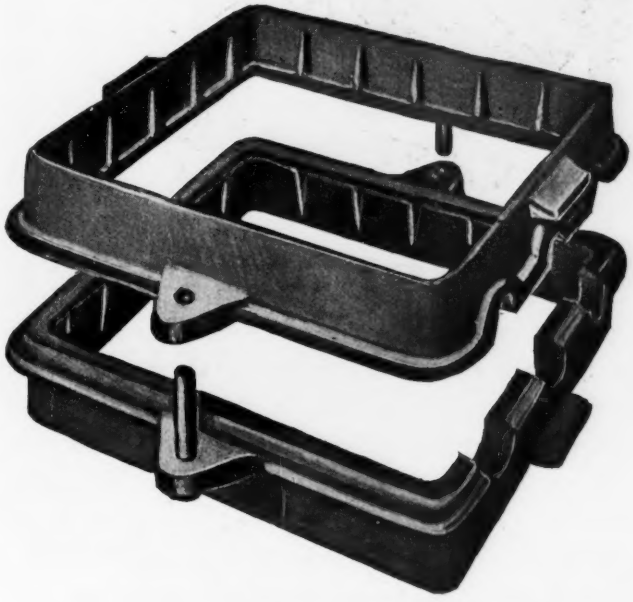
CINCINNATI CHICAGO PITTSBURG

Brass Molders' Flasks

Of Every Style and Size



Furnaces, Drying Stoves, Spill Troughs, Clamps, Boards, Tongs, Crucibles, etc., etc.



All our flasks interchange with any of same size made by us.

Our own foundries ensure prompt shipments.

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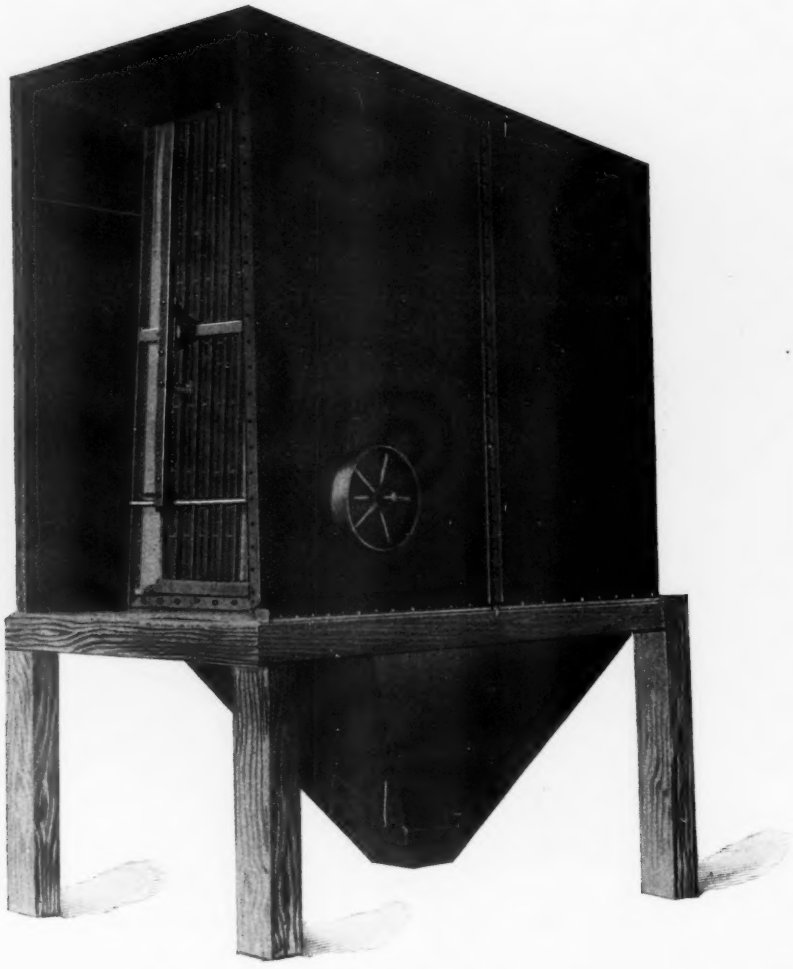
Founded 1845 **NEWARK, N. J., U.S.A.**



Steel Case Dust Arrester

We can take all the dust from your mill room coming from your cleaning mills, and return the air anywhere in your shop perfectly clean. No dust passes through the fan to cut out the blades. You can save the price of this Arrester in one year, taking into consideration the life of the Fan, wear and tear on machinery, and goods spoiled by dust.

Write us, and tell us your troubles. We manufacture a full line of Cleaning Room machinery, and if your cleaning room is not up-to-date, you are loosing 100% on it every year.

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Office and Works: Cor. Train and Junction Sts.,
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The Shortest Route to Core Room Success---

is through the Millett Core Oven. The best argument in its favor is the oven itself---giving continuous satisfaction. Compare it with the next best and you will see what we mean. It gives you perfect cores, when you want them, and is commended by users everywhere. Then there is its economy. Isn't the best at a saving in dollars and cents a conclusive argument for the progressive business man?

Millett Stationary Core Oven

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Simple—Durable—Reliable
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"Keller" and "Chicago" Sand Rammers.

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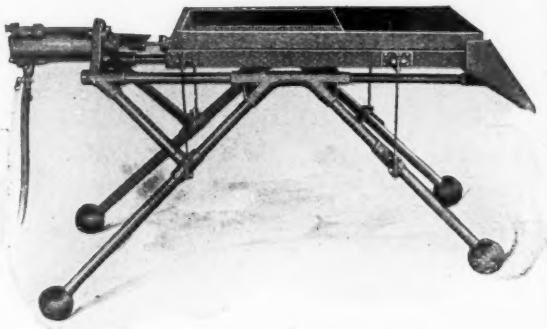
One hammer will do the work of from 5 to 8 men.

"Chicago" and "Keller" SAND RAMMERS are used by all modern foundries. They are fitted with stuffing boxes and hardened bushings to protect them against wear.



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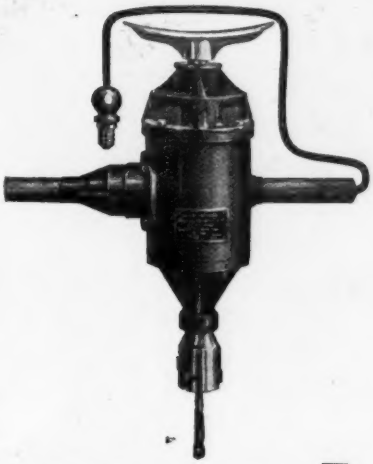
Branch offices everywhere.



Breast Drill, weight 13 lbs, Capacity ⅝" in iron or steel

DUNTLEY ELECTRIC TOOLS

Are especially adapted to Foundry requirements. They are strong, durable and efficient and guaranteed to perform the service for which designed.

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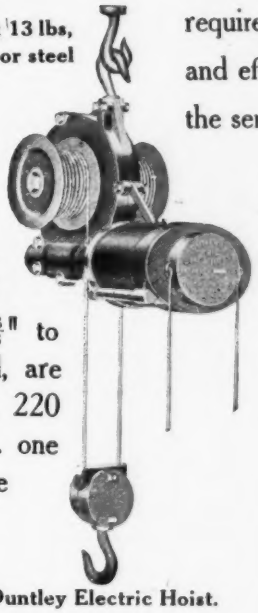

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Manufacturers Air Compressors, Pneumatic Tools, Hoists, Electric Drills, Etc.

Good Fortune and the Steam Hydraulic are Sisters.

A big concern decided to put in a Direct Acting Steam-Hydraulic Elevator of about 40 ft. lift, like this cut.

They dug the well in the old fashioned way. Soon they struck rock. It took a long while and cost over $300 to blow out that hole over 45 feet deep. But in putting down the well through the rock they struck several springs and now they have right in the center of the works a great well of living water.

They will give up the use of the city water and setting a pump in the well by the side of the elevator ram supply the whole plant free of cost for water.

The well for the Ridgway elevator will save them hundreds of dollars—while the elevator itself will save them thousands.

If you want to be happy and prospered you will put in Ridgway Elevators. Do you have any idea of the concerns who are getting them and why?

Well, maybe you will wake up some of these days and do a little looking into what it means to

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Craig Ridgway & Son Co.

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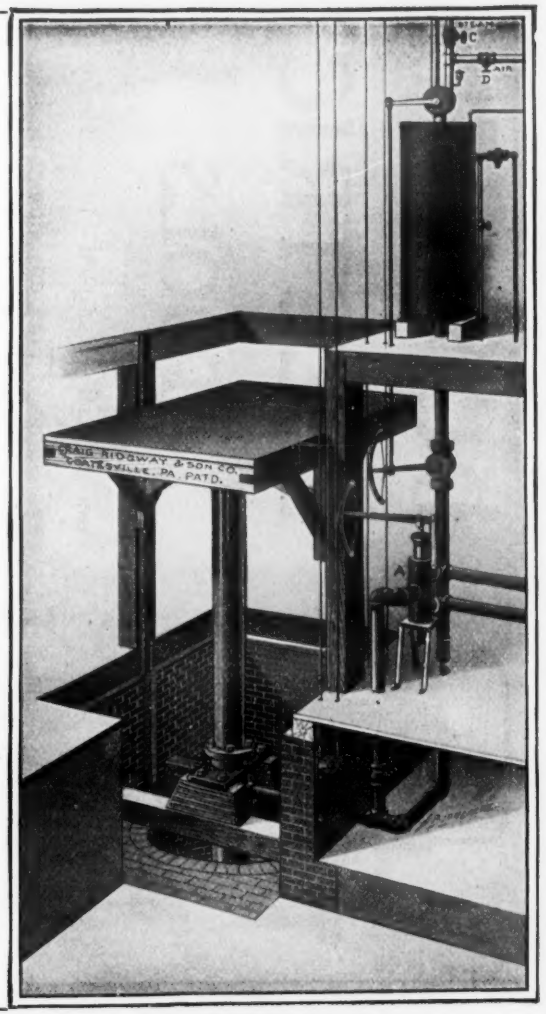

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for General Foundry Use

NOTHING LIKE THEM FOR THE FOUNDRY.

PORTABILITY.

It is on this point which we base our claims of great utility and economy of operation. Every shaker is emphatically a portable machine, and can easily and readily be moved from one part of the foundry to another to screen your sand just where you intend to use it.

Hanna Engineering Works

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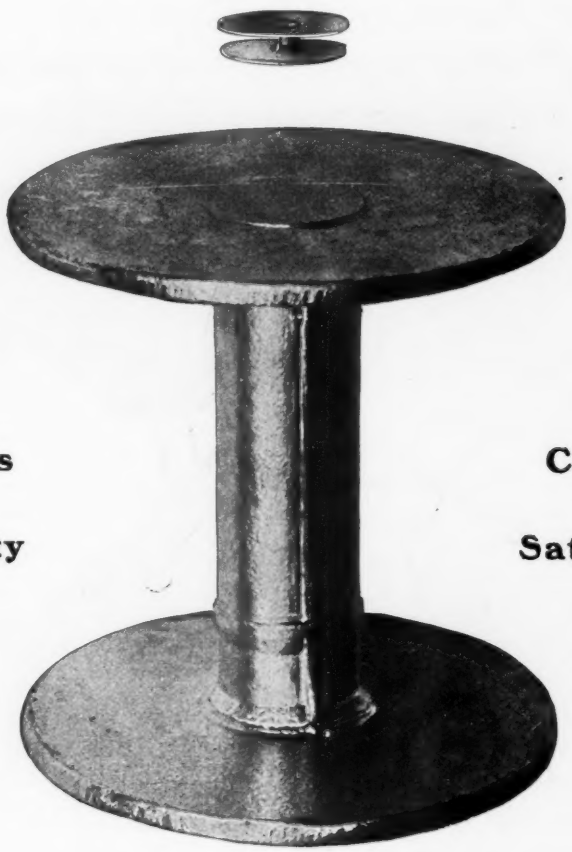
Thos. W. Pangborn Co., 227 Fulton St., New York City.

Pneumatic Engineering Appliances Co. Ltd., Palace Chambers, Westminster, London Eng.

S. Obermayer Co., Chicago, Cincinnati.

70,000 Lindsay Chaplets—



The Chaplets of Certainty

The Chaplets of Satisfaction

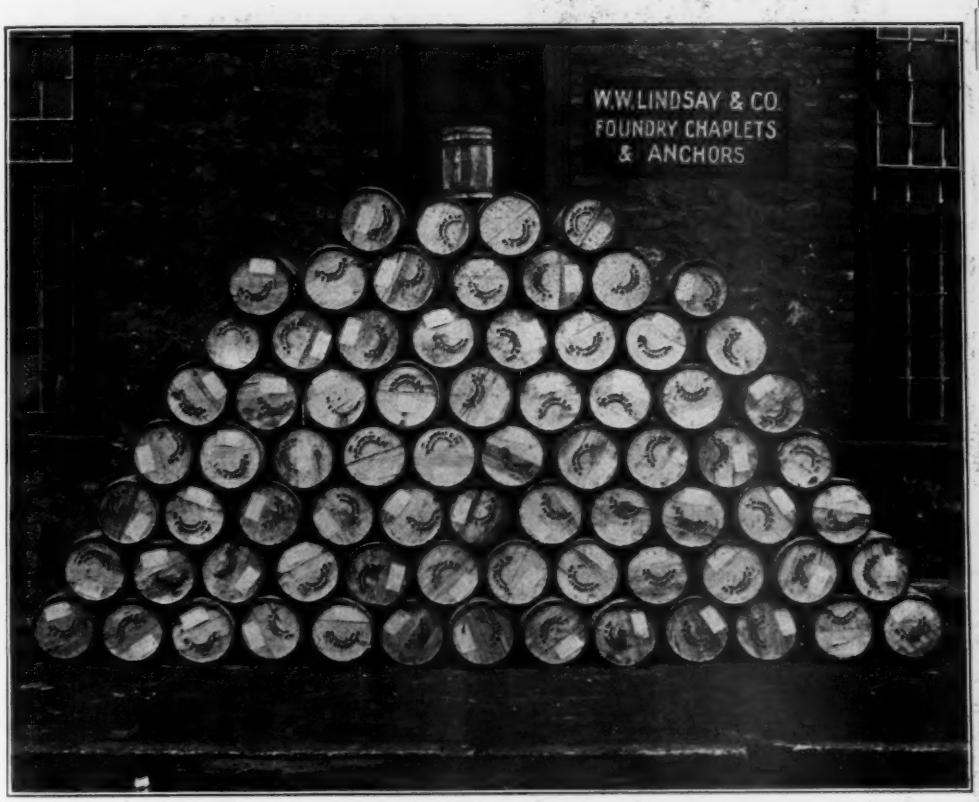
Any size Chaplet from the largest to the smallest.
All manufactured with the same care and accuracy.

W. W. Lindsay & Co.

Harrison Building Philadelphia

—One Day's Shipment.

Such is the result of Manufacturing Goods of Real Merit.



When foundrymen buy Lindsay Chaplets in such quantities, after a thorough test, isn't it safe for you to give them a trial? We leave it to the chaplets to make good. Let us mark a keg with your address.

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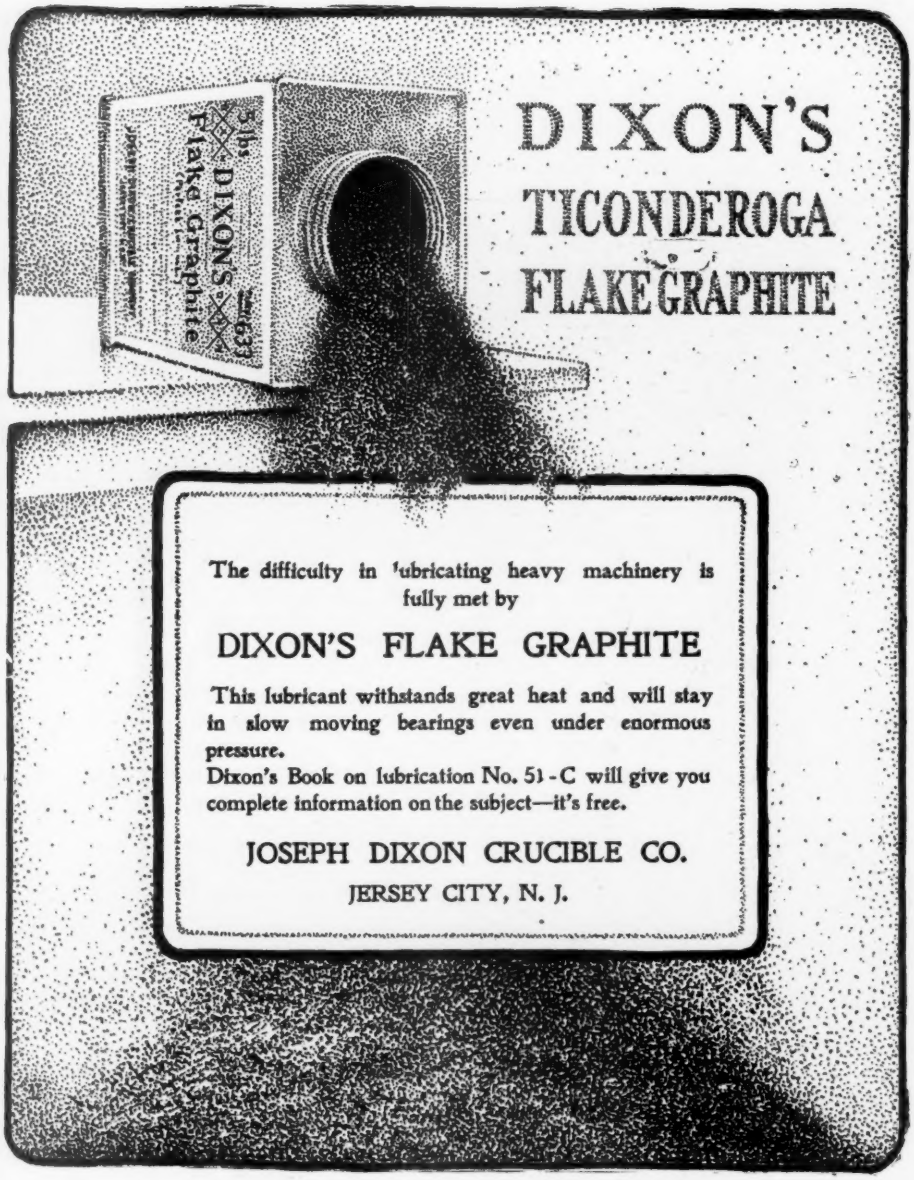
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DIXON'S
Flake Graphite
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The difficulty in lubricating heavy machinery is fully met by
DIXON'S FLAKE GRAPHITE
This lubricant withstands great heat and will stay in slow moving bearings even under enormous pressure.
Dixon's Book on lubrication No. 51-C will give you complete information on the subject—it's free.
JOSEPH DIXON CRUCIBLE CO.
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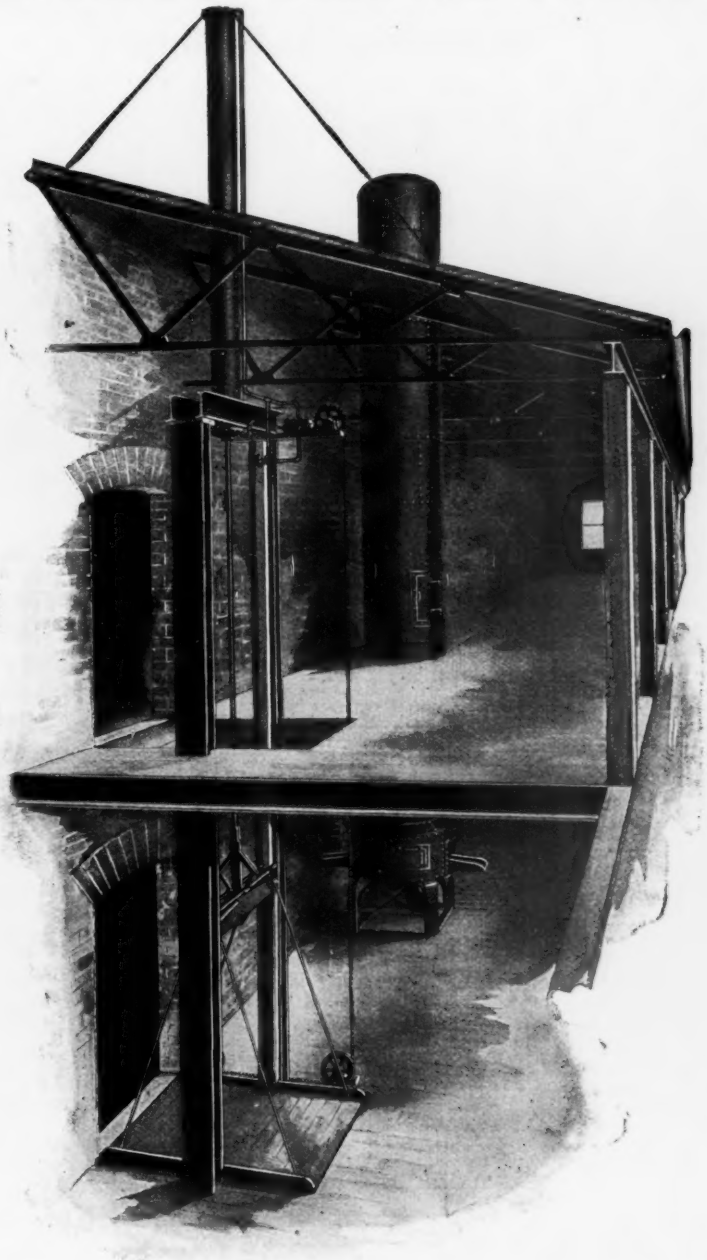
Pneumatic Foundry Elevators



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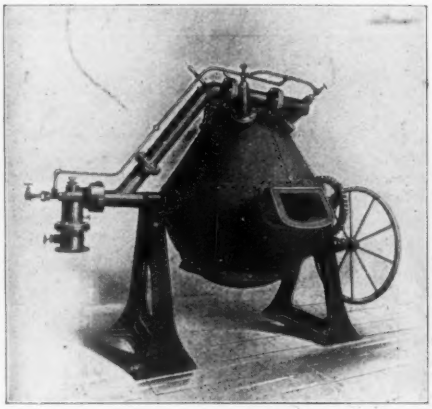
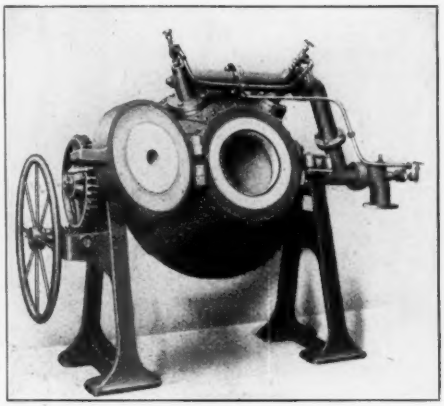
Schwartz Melting and Refining FURNACE

Simplicity—Durability



Melting position



Charging position

Best and cheapest method for melting brass, copper, bronze, gray iron and malleable iron.

Produces better metal and perfect castings. Less loss in shrinkage and no ashes. No crucibles are required.

Made in sizes from 100 lbs. to 10,000 lbs. capacity.

Fuel used: crude oil, fuel oil or gas.

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A recommendation in itself

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Westinghouse Electric Co.
Westinghouse Air Brake Co.
Newport News Shipbuilding Co.
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"Sold on guaranteed results"

Write for new catalogue.

The Hawley Down Draft Furnace Co.

CHICAGO U. S. A. NEW YORK

We cordially invite the representative Brass Foundry interests of the country to a complete investigation of the advantages and merits of

The "Steele-Harvey"
CRUCIBLE BRASS MELTING FURNACE

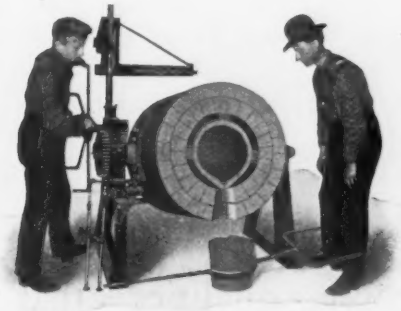
over the old coke or coal method.

Our experience and knowledge of the interests of the Foundry has been based upon an experience commencing with the old way, and developing by degrees to the present, in connection with Oil or Natural Gas and Air. We do not claim **impossible** or **extraordinary** advances, but a development of the method of melting, which is **clean, economical, labor saving,** above ground, **no ashes,** or **waste** of metal therein, a **reduction** in **cost** of fuel, using that only **which is necessary to melt** a given quantity of metal, **one** furnace doing what **3** similar coke crucibles formerly accomplished. An honest machine, which if purchased will economize for cost value within a short time, **rapidity** of **melting**—reduction in **loss**—and extension in life of crucible—maintaining a **high quality** of **metal**

Our Standard

(Patented in the United States and all foreign countries.)

IN MELTING POSITION



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When you want it—"**It is there with the goods.**" **Do not hesitate,** but request one on **trial** and **approval,** and acceptance when satisfactorily demonstrated by our representative. On account of the enormous demand we have doubled our plant capacity and are in position to ship within 24 hours of receipt of order.

Built for capacities from **120** to **1,500** lbs. **per heat.**

Don't delay—"the other fellow will get ahead."

Write for Catalog.

The Monarch Engineering & Mfg. Co.

BALTIMORE, MD., U. S. A.

Works: Curtis Bay, Md.

EUROPEAN DEPOT—J. W. Jackman & Co., Ltd., "Caxton House," Westminster, London.

America's Best

We refer to iron---Cherry Valley Iron. A soft, strong and uniform quality for the foundry, obtained by careful selection of ores and closest attention at the furnaces. If you make machinery castings for particular people, Cherry Valley Iron is what you need. It's easy enough to be granted a small concession in price on an off-grade Iron, but you pay dearly for it in the end. Know, as hundreds of foundrymen do, those qualities that make famous the

Cherry Valley Iron.

Cherry Valley Iron Co.
Pittsburg, Pa.

William Sellers & Co. Incorp.

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Modern Machine Tools

We illustrate hereunder one of our specialties for Foundry use, which has proved very satisfactory and profitable in service.

Centrifugal Sand Mixing Machine

We have furnished these machines to many users and shall be pleased to supply full particulars upon application.

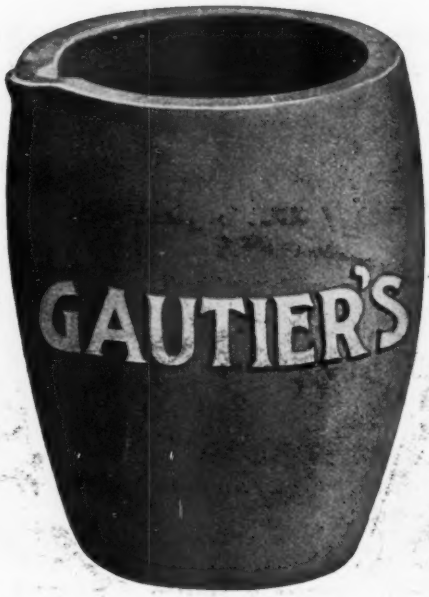
TRAVELING CRANES JIB CRANES

SHOP TURNTABLES

Improved Injectors for Boiler Service

SHAFTS, HANGERS, PULLEYS, COUPLINGS, Etc.

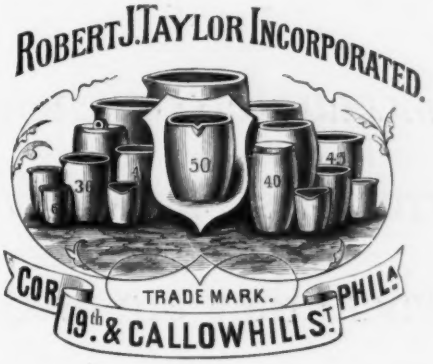
FOR THE TRANSMISSION OF POWER.



THE STANDARD

J. H. Gautier & Co.

JERSEY CITY, N. J.



This trade mark stands for the acme of crucible uniformity

If you are not satisfied with the results you are receiving, the "Taylor" Crucibles will bear investigation. They are the result of years of most careful study.

A trial will convince you.

Robert J. Taylor, Incorporated

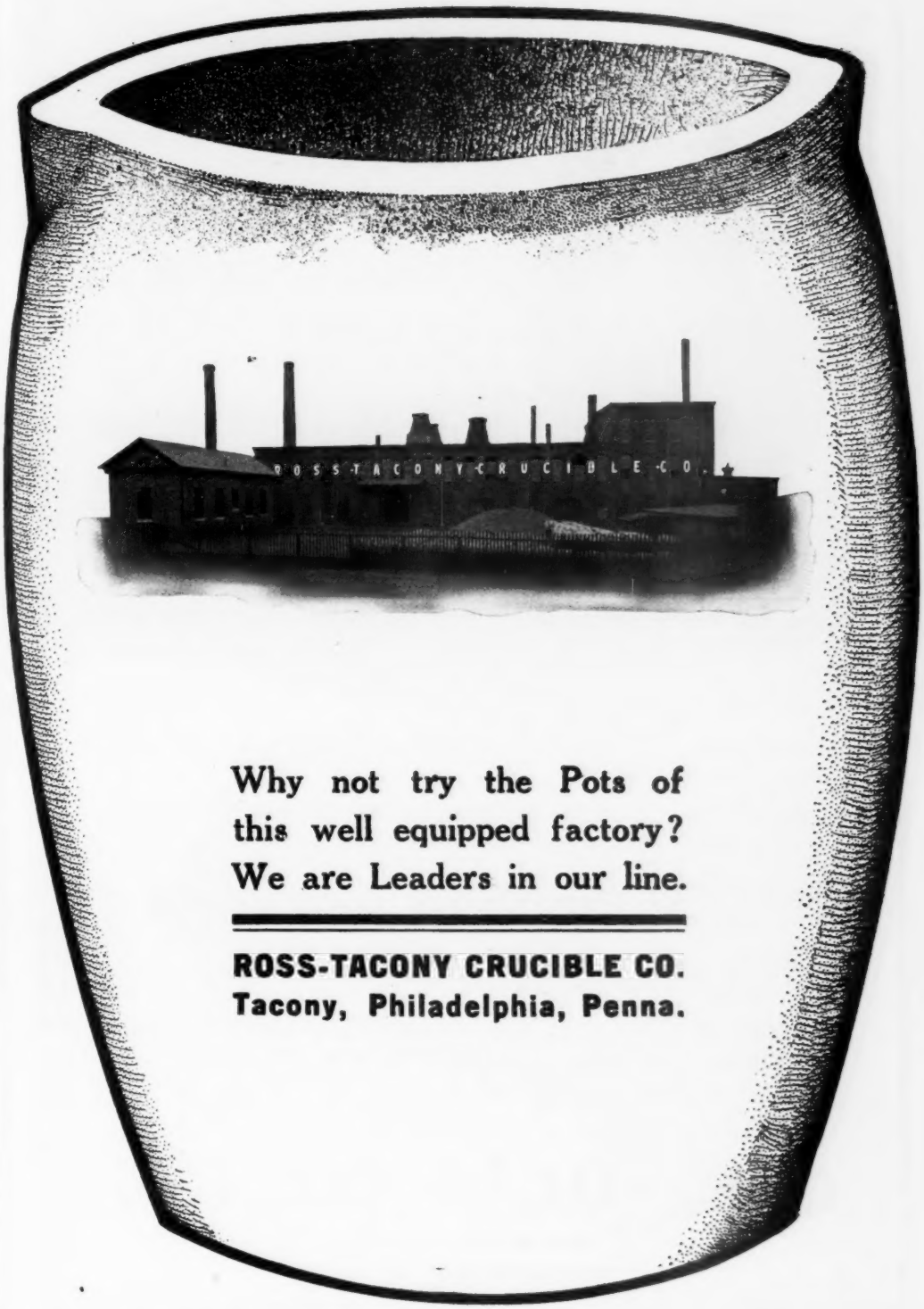
1900 to 1916 Callowhill Street

PHILADELPHIA, PA.

We concentrate our energies--we make crucibles only. We make them where they are used--in the midst of the greatest steel and brass industries of the United States. We know your needs. Send us an order.

McCullough-Dalzell Crucible Co.

Pittsburgh
Pa.



Why not try the Pots of this well equipped factory? We are Leaders in our line.

ROSS-TACONY CRUCIBLE CO.
Tacony, Philadelphia, Penna.

C. E. Mills, Specialist

REFERENCES GIVEN TO THE LARGEST FOUNDRIES IN THE COUNTRY.

MILLS DRY CORE COMPOUND

No. 1 for heavy or ordinary Core-making No. 2 for any work, but is especially adapted for Malleable Iron, Brass and Steel Foundries. It goes three times as far as Rosin, and twice as far as Flour. No blow and no absorption of moisture.

SYRACUSE X-XX-XXX CORE OILS

Perfect adaptation for all work. Best Core Oil on the market.

SYRACUSE LADELENE COMPOUND

Facing, Core Wash, Lining for Ladles, Cupolas, Locomotive and Stationery Fire Boxes, Gas Work, etc.

Half the cost making cores with our MILLS DRY CORE COMPOUND.

We have Agencies in the following cities, who carry our goods in stock, whose territories are as specified:

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HILL & GRIFFITH CO., Cincinnati, O.
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WHITEHEAD BROS. CO., Providence, R. I.
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THE DOMINION FOUNDRY SUPPLY CO., Ltd., Agents for Canada.
Offices and Warehouses—122 Wellington St., Toronto, Ont.
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GLUTRIN

A LIQUID ADHESIVE CORE SAND BINDER

¶ In the steel foundry it is now an admitted and acknowledged fact that 1 gallon of glutrin is equal to 2 gallons of molasses. Can you afford to ignore this fact?

¶ In the iron foundry its merits are fully recognized as evidenced by the steady growth of our shipments. Are you a customer?

¶ Sold in tank cars or barrels---the latter containing from 50 to 53 gallons each.

¶ Our stencilled brand and weights are a guarantee of the quality and of the quantity on the basis of the exact weight--10½ pounds to each gallon.

ROBESON PROCESS CO.

CAMDEN, N. J., U. S. A.

¶ GLUTRIN CORE BINDER is carried in stock and sold by *THE S. OBERMAYER COMPANY* from their houses in *Cincinnati, Chicago, Pittsburg and St. Louis.*

¶ GLUTRIN CORE BINDER is carried in stock and sold by the *HAMILTON FACING MILL CO.* from their houses at *Hamilton, Ontario, and Montreal, Quebec, Canada.*

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WHITING FOUNDRY EQUIPMENT CO.

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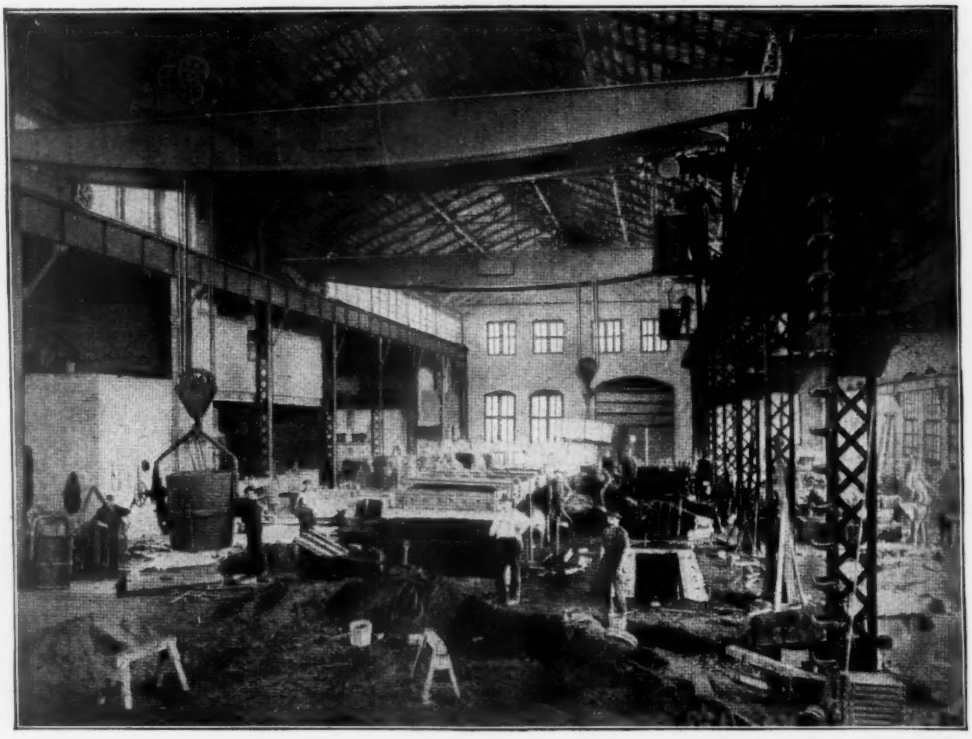
Engineers Designers Manufacturers



Two Three-Motor Electric Traveling Cranes, capacity twenty tons. Bates Machine Co., Joliet, Ill.

Cupola, 2000 in use.

ELECTRIC TRAVELERS CRANES OF ALL TYPES

Cupolas and **Machinery** for **Complete equipment** of **Foundry Plants. Contracts taken covering buildings** and **entire Installations. Inquiries Solicited.**

Have you our Catalogs? If not, send for them. Tell us about your Foundry Plans—we may be able to assist you.

THE FOUNDRY

Vol. 29, No. 6. CLEVELAND, OHIO, FEBRUARY, 1907. Whole No 174

The Manufacture of Cast Iron Car Wheels.

A Review of the Development of the Circular Floor, Straight Line and Continuous Systems—Introduction of Labor Saving Equipment.

OPERATING methods, in no branch of the foundry industry, have reached a higher development than in the manufacture of cast iron car wheels; and so rapid has been the recent progress that, apart from a few novel systems — which have not been recognized by their general adoption — two have been evolved which are today considered standards. In this advancement the foundry engineer played no small part, as the design of the floors and use of labor-saving machinery to facilitate and increase production, reflect his skill. In only one plant has the molding machine been utilized with any degree of success, although manufacturers in this line have experimented for years to ultimately eliminate hand labor. With this method of making the molds practically fixed, for the immediate future at least, the burden of cost reduction ne-

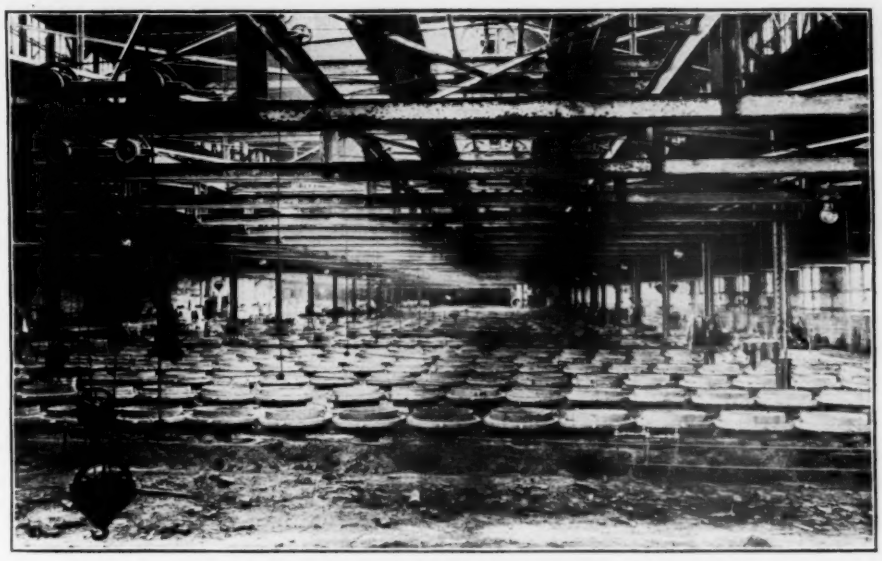


FIG. 1.—GENERAL VIEW, STRAIGHT LINE WHEEL FOUNDRY.

cessarily devolved upon other departments.

The circular floor, which still predominates, but which is hard press-

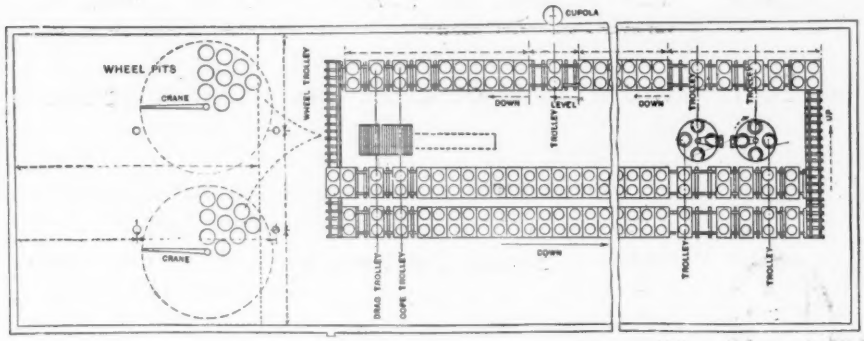


FIG. 2.—TERRE HAUTE PLANT OF THE AMERICAN CAR & FOUNDRY CO.

ed by the straight line system, Fig. 1, was used in the early days of car wheel manufacture when it was served by the irksome hand-power jib crane for aiding the molder in handling the heavy flasks and chill, the floors are commanded by electric trolleys and hoists, either air or electrically driven. That the molder's daily output has been raised to twenty-five wheels, with the assistance of only one helper, shows to what extent production has been increased, and labor costs have otherwise been greatly curtailed by the systematic movement of the hot metal to the floors and

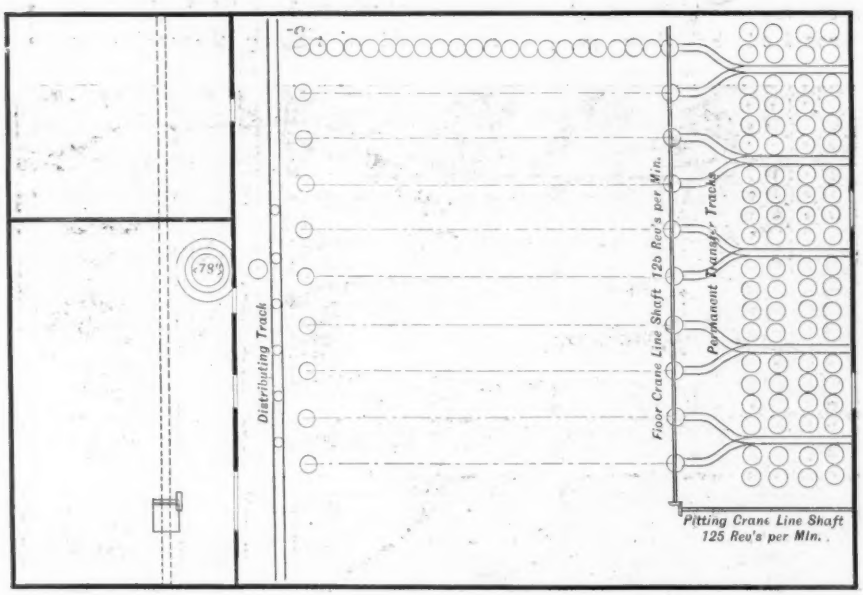

Distributing Track
Floor Crane Line Shaft 125 Rev's per Min.
Permanent Transfer Tracks
Pitting Crane Line Shaft
125 Rev's per Min.

FIG. 3.—PLAN OF ONE OF THE FIRST STRAIGHT LINE FLOOR PLANTS.

ladles, and for shaking out the wheels. This crane is now equipped with a pneumatic hoist, while the straight

the wheels to the annealing pits. Advocates of these two systems maintain that the interruption of opera-

tions; and delays occasioned by accidents to the ponderous machine parts, which are essential features of the several continuous processes in use, more than overcome their lessened cost of production; and it is also claimed that the use of the chills more than once a day results in an increase in the number of bad wheels, and considerable difficulty has also been

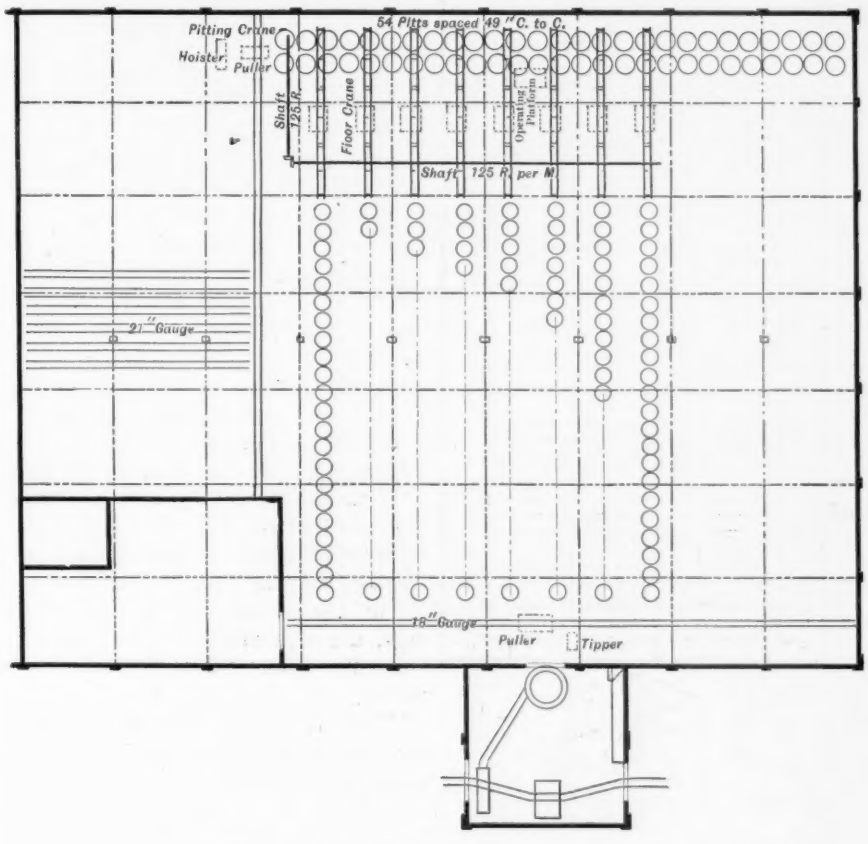


FIG. 4.—A LATER STRAIGHT LINE SYSTEM.

experienced in tempering the sand for its repeated use.

Continuous Processes.

Wheels are made by a continuous process in the plant of the Central Car Wheel Co., McKees Rocks, Pa., the entire operation being divided into four parts, consisting of the making of the cope and drag, the pouring of the mold and the shaking out of the casting. The buggies carrying the flasks traverse a circular track, their movement being controlled by a rope haulage system. While a mold is being poured, the buggies are at rest, giving each man engaged on the successive steps an opportunity to proceed with his assigned part. This division of work to a large extent reduces the number of skilled men required, and greatly increases the daily output of each molder. Sand is delivered by a conveyor, and, after it is shaken out, is dropped through a grating in the floor into a pit where it is tempered and again supplied to the elevator for repeated use.

At the Terre Haute (Ind.) plant of the American Car & Foundry Co., a continuous system has been evolved which combines the molding machine with other interesting features, as

shown in the ground plan Fig. 2. The buggies which carry the flasks to and from the molding machines, operate on a rectangular narrow gage track system, the molds being made at one end of the foundry, and the wheels are shaken out and pitted at the other. The machines are of the squeezer type, and are operated by air, one being used for producing the

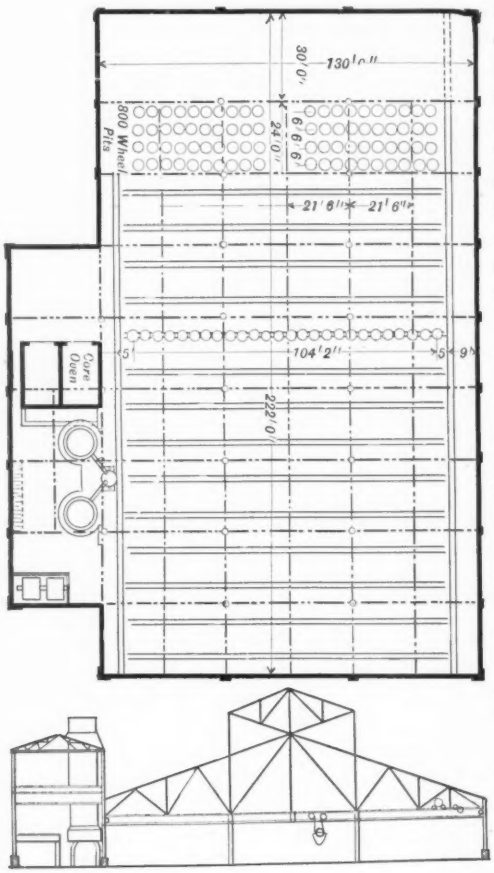


FIG. 5.—MODERN STRAIGHT LINE FOUNDRY.

cope and the other the drag. Each carries four duplicate patterns on a circular table which is given a quarter turn after the mold has been pressed. After the removal of the mold, the flask is placed over the pattern, another turn bringing it underneath the sand hopper. When the surplus sand has been removed by a sweep operating on a shaft attached to the hopper bottom, the flask is moved to a position above the pressure cylinder where the mold is made. The construction of the drag flask is unique, inasmuch as the ring and bottom plate customarily used are dispensed with entirely and make it possible to produce the mold by pressing the sand against the pattern. Efforts to make molds by pressing an adjustable pattern into the sand did not prove satisfactory, as the sand working into the pattern joints caused rapid wear. The drag part of the mold is made on the first machine and is placed on a buggy by means of a trolley, the pattern being lifted off by hand, in contrast with the lifting of the cope from the pattern. After the cores are set, a forward movement of the buggy carries it under the trolley serving the cope machine, and after the cope has been set, the mold is clamped and is again moved forward to a point in front of the cupola where it is cast. After sufficient time has elapsed for cooling, the cope flask is lifted off, and, after the sand has been shaken out over a grating in the floor, it is carried by trolley to a buggy on the opposite track where the drag flask is already in place. This reduces the handling of the flask to the minimum as in the movement of the empty flask, the cope machine is reached first, and allows the chill to be lifted from the top.

When the wheel has been shaken out, the drag part is lifted off, and after the removal of the sand, is replaced on the buggy from which it has just been taken. After traversing the track in front of the wheel pits, it is transferred to the empty flask track, and is in a position to receive the cope as noted above. That the chills may have sufficient time to cool before they are used again, a storage track shown in the foreground of the plan view, is necessary. The sand, when shaken out, passes through a grating in a double deck hopper where it is tempered and carried to a reciprocating conveyor, after which it is screened cooled and delivered to the hoppers over each machine. In both systems

the iron is melted continuously. Another process, which is now being tried, combines the circular track and a squeezer molding machine, but nothing definite is yet obtainable relative to the success of this venture.

Early Straight Floors.

The straight floor was first introduced within the last two decades, Fig. 3 showing one of the earlier arrangements, installed at Berwick, Pa. In this plan the cupola was placed in the center of one end of the foundry and the hot metal distributing track extended the width of the building instead of its length, the latter being in keeping with present day practice. There were, furthermore, only twenty-two wheels to the floor, as compared with twenty-five now generally made, and the distance from center to center of the floors was only nine feet, as against twelve in the more modern foundries. Floor cranes facilitated the handling of the metal and flasks, and the wheels were delivered to the pits on buggies, the track arrangement being somewhat unique. The 78-inch cupola does not compare favorably with the 102-inch monsters now being installed.

The eight-floor foundry, Fig. 4, built somewhat later, shows some progress and a slight improvement in the general arrangement. The cupola is at one side of the plant at about the center of the floors, and the hot metal distributing track parallels the length of the building. The floors, however, were only spaced a distance of nine feet, and the number of wheels required of each molder daily, was not increased. The location of the annealing pits opposite the cupola was never repeated in subsequent plants. The length of the blast pipe, shown in the plan, has also been reduced to the minimum.

Comparison of Straight and Circular Floors.

Plans of a 325 wheel foundry, arranged for both straight and circular floors, are shown in Figs 5 and 6. That the straight floor system can be operated within a smaller area than that required for the jib crane method is indicated by a comparison of these two foundries. The molding department of the circular floor plant is giv-

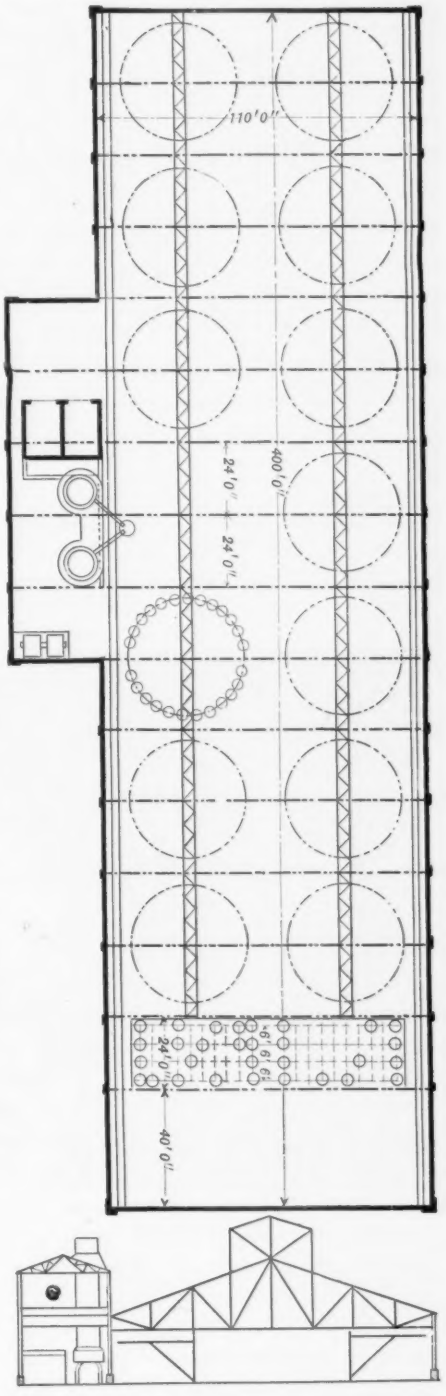


FIG. 6.—MODERN CIRCULAR FLOOR FOUNDRY.

en 36,960 square feet, while the straight line system requires only 21,580 square feet for a like capacity, and the foundries, including other departments, cover 44,000 square feet and 28,600 square feet respectively. The saving of cost in the erection of buildings, and smaller land area, were the factors which led to the adoption

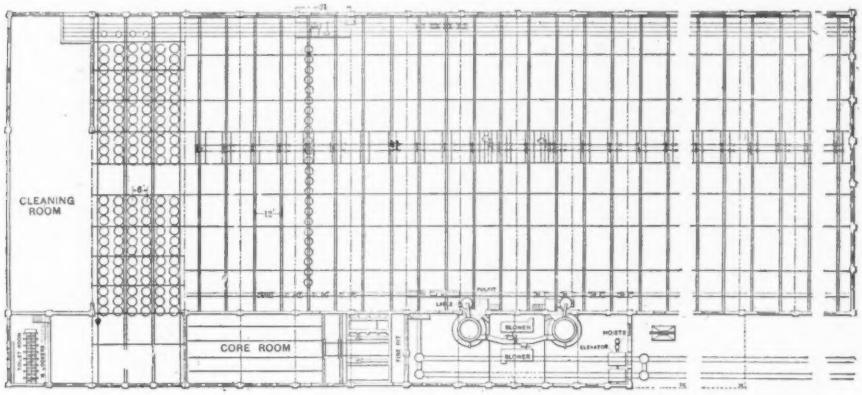


FIG. 7.—WHEEL FOUNDRY, CHICAGO, MILWAUKEE & ST. PAUL RAILROAD.

on the straight floor plan by the company to which these designs were submitted. Thirteen floors of twenty-five wheels each were provided in the circular arrangement, and the hot metal was to have been conveyed in ladles on trucks hauled by hand over floor plates, and the wheels were to have been delivered to the annealing pits on buggies operated on tracks paralleling each side of the foundry. Although twenty-six wheels are laid out for each of the straight floors, only twenty-five will be made, and the hot metal will be distributed on a track paralleling the cupola side, while the wheels will be conveyed to the pits on buggies operating on a track extending the length of the building on the opposite side. Air will be furnished the two cupolas by

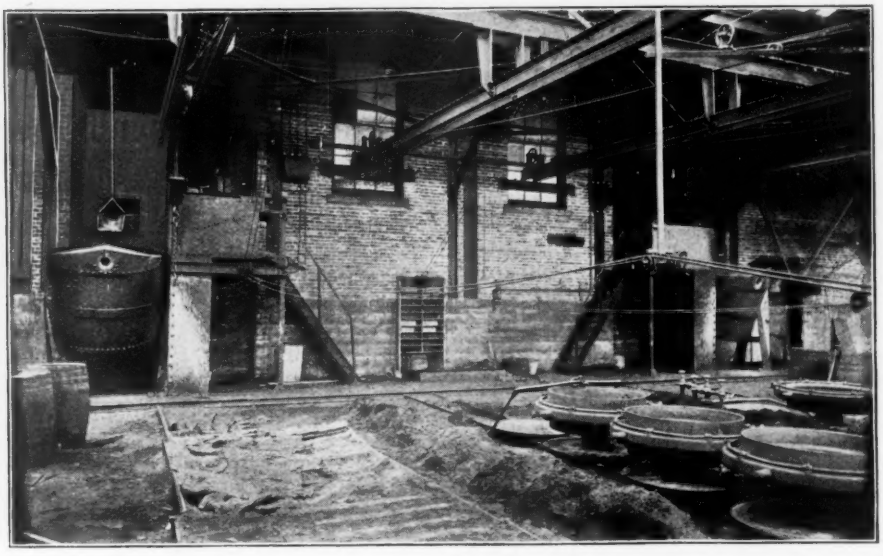


FIG. 8.—CUPOLA SIDE, MODERN CAR WHEEL PLANT.

blowers placed between them, and located on a mezzanine floor directly underneath the charging platform. Individual air hoists will serve each floor.

A Model Straight Floor Plant.

A plan view of the foundry of the Chicago, Milwaukee & St. Paul railroad is shown in Fig. 7, represents the highest development of the straight floor method. Labor-saving machinery has been installed throughout, and the number of employes required for operating the circular floor plant, which was replaced, has been greatly reduced. The hot metal and wheel tracks parallel the length of the building on opposite sides, and the two cupolas, Fig. 8, are centrally located. The tilting of the reservoirs is electrically controlled, and provisions were made for their operation by hand for emergencies. The blower room, being located on a mezzanine floor below the cupolas, reduces the piping to the minimum, and gives the cupola operator direct control of the blast. The operation of the blowers is adjusted and maintained by regulators which control the speed of the motors. The charging floor is designed with a view of facilitating the rapid handling of a large amount of material. The charging cars are raised to the platform by two pneumatic elevators, and storage tracks, provided for each cupola, are connected by turn tables with the main tracks and the tracks leading to the cupolas.

The Altoona plant of the Pennsylvania Railroad company is the largest car wheel foundry in the country, having a producing capacity of 900 wheels daily, its molding department being divided into thirty-six floors. The six cupolas are distributed in pairs along one side of the building, and the two groups of annealing pits are located at either end to reduce the carrying distance of the hot wheels.

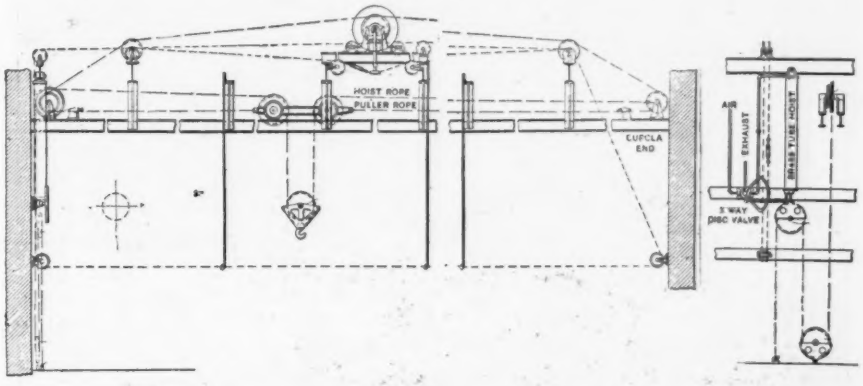


FIG. 9.—PLAN AND END ELEVATION OF HOIST.

A rather unique circular floor foundry has just recently been completed by the Griffin Wheel company, at Pullman, Ill., which has its cupolas located at one end of the building, and the metal is distributed to the floors by means of overhead trolleys. The annealing pits are placed opposite the cupolas, and the wheels are delivered to the pitting cranes on buggies operating on tracks between the floors.

Floor Hoists.

Operated by both air and electric power, floor hoists, of several different types, are in successful use. Notwithstanding the smoke and dust, enclosed motors have shown a long life and comparatively small expenditure for repairs. The electric hoists used in the South Altoona plant of the Pennsylvania Railroad company were built by Pawling & Harnischfeger, Milwaukee, Wis. They operate on the lower

flanges of I-beams extending the length of the floors, having two of their four wheels geared for the trolley drives. The motors for both hoist and trolley, are attached to opposite sides of the frame and balance each other, and the hoist is so hung within the trolley frame that the load on the hook comes directly beneath the center of the wheel base. To the lower side of the hoist motor are attached two reversible controllers in the form of outriggers, which permit of the operation of the hoist without greatly interfering with the molder's work. One lever controls both the hoisting and lowering, as well as the trolley travel in either direction, inasmuch as a turn of the controlling bar in a horizontal plane affects the trolley travel, while a tilting of the ladle actuates the hoist motor. The controller connections are so arranged that the motion of the operator's hand is in the same direction as the desired movement of the machine.

FIG. 10.—HOT WHEEL TRACKS, STRAIGHT LINE SYSTEM.

The hoists installed in the Chicago, Milwaukee & St. Paul foundry by the Whiting Foundry Equipment Company, Harvey, Ill., shown in Fig. 9, are air driven, and the travelers are propelled by a double friction motor drive. Separate hand ropes, suspended from the floors, control the forward and backward movement of the traveler, and the ropes actuating the same, move

in the same direction. The trolley drive is obtained from two overhead shafts, geared together and operating in opposite directions, on which friction wheels are mounted, and the drum, carrying the traveler rope is mounted on a shaft with a friction pulley. This shaft is mounted in floor and parallels the rope controlling the traveling movement.

Prior to the adoption of the friction motor drive, the power was transmitted from the driving shaft by four belts to each floor. It will be noted that the travelers in the Altoona shop are provided with inde-

FIG. 11.—ANNEALING PITS SERVED BY THREE DOUBLE HOIST ELECTRIC TRAVELING CRANES.

eccentric bushings and is shifted by a lever to engage with either friction wheel. The hoisting movement is accomplished by means of an independent cylinder of the air-balanced type, Fig. 10, provided with a top head arranged for attaching it to the building frame-work, and a bottom head provided with a stuffing box for the piston rod. The valve, which is independent of the cylinder, is attached to the building, and is provided with a controlling lever having a quadrant to which the controlling hand rope is attached, which extends the length of the pendent motors, whereas the power, for the entire twenty-four floors at Milwaukee, is transmitted by two overhead shafts extending the length of the foundry, and operated by two motors.

Pitting Cranes.

Numerous types of pitting cranes are in use, and practically all are electrically operated. Those used by the Pennsylvania Railroad company at Altoona are equipped with four hoists, a fifth being provided for emergencies. The three cranes, Fig. 11, installed by Pawling & Harnischfeger, Milwaukee, in the foundry of the Chi-

cago, Milwaukee & St. Paul Railroad company, serve two rows of pits each, and are equipped with two 1,000-pound hoists having center bore tongs which lift the wheels from the buggies and deposit them in the pits. Suspended from, and underneath the crane bridges, are the operator's cages which clear the tops of the pits by about one foot, permitting the operator to travel with the work. A switchboard for the motors is fastened to the cage, and the two hoists, attached to the under side of each bridge, are so located that the hoisting ropes and bottom blocks hang directly over the center line of the pits.

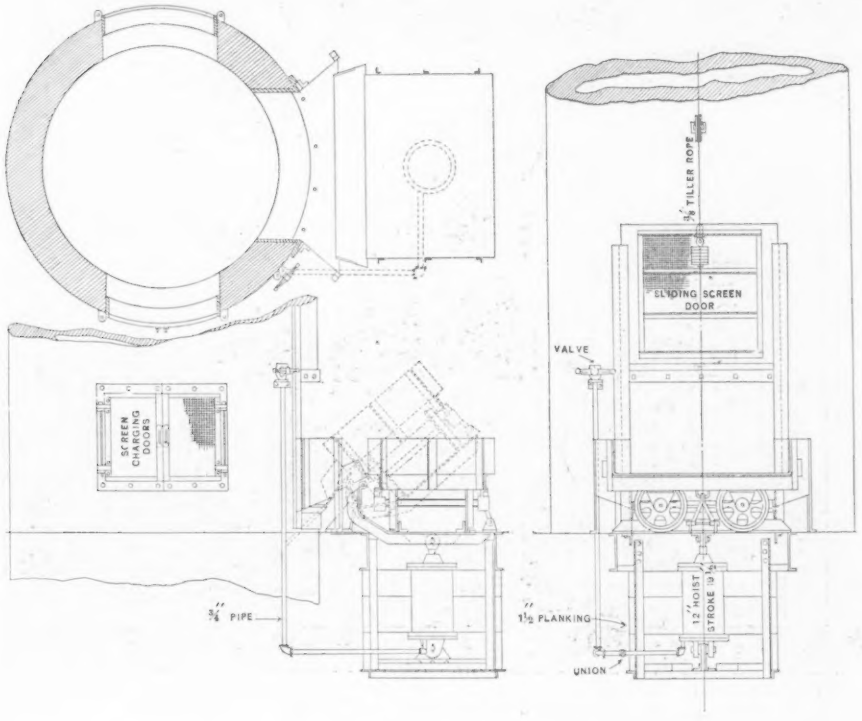


FIG. 12.—CUPOLA CHARGING MACHINE.

Charging Machine.

The cupola charging machine, shown in Fig. 12, is built by the Whiting Foundry Equipment Co., Harvey, Ill., and has been installed in a number of plants recently erected. By its use the charges on the cars are dumped into the cupola by means of an air hoist, which raises one side of the car to an angle of 40 degrees, the other side remaining almost stationary. When in position in front of the charging door, the hoist raises the floor plate on which the car rests, and to prevent it from sliding off the track, the car is held in place by means of a hook which engages an eye fastened to the side sills. A steel plate lip, extending from the charging door, prevents the dropping of any of the material outside of the cupola.

Bottom Door Hoist.

To facilitate the closing of the cupola bottom doors, the device shown in Figs. 13 and 14 has been widely adopted. It consists of an air hoist with a chain attached to its lower end which engages an eye in the center of the door, passes over a wheel secured to the cupola support, and the upward movement of the hoist hook raises the door in place. When in position, each door is held by a screw

prop bearing on a cast iron base underneath the cupola. A steel prop is wedged between the screw supporters which holds the doors in place after the removal of the screw props just before the bottom is to be dropped, and by means of a long bar with a hook-

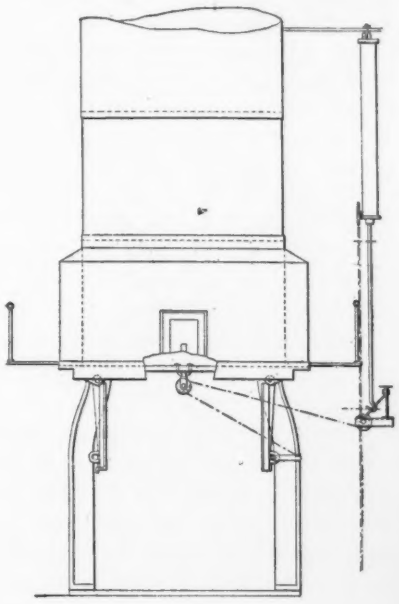


FIG. 13.—BOTTOM DOOR HOIST.

end this prop is upset, and bottom is dropped without endangering the employes engaged in this work.

Wheel Breaker.

The old style "plum bob" wheel breaker is also being rapidly replaced by a wheel breaking machine, equipped with a 2,000-pound cast iron drop, which falls from a height of from 12 to 16 feet and is lifted by an air hoist, attached to the side of the frame work, which is of heavy steel construction. The machine is patterned after a pile driver in general design, the drop moving in guides and is automatically released.

For the wheels now generally used only center and pan cores are required, although core gates are used to some extent instead of the ordinary sand gates. Nor is the contracting chill used as extensively as heretofore, as it has been largely replaced by one of the ordinary type which gives the required chill depth. Annealing pits vary in height from 10 to 16 feet, this being largely governed by local conditions, and the cooling of the wheels requires from five to six days.

Physical Tests.

The specifications, to which the wheels must conform, and the tests, to which they are subjected, prescribed by the Master Car Builders' Association, are most severe, and in this connection may be briefly referred to. Wheels weighing 600, 650 and 700 pounds are for cars 60,000, 80,000 and 100,000 pounds capacity, respectively. Wheels of the same normal diameter must not vary more than ¼ of an inch above or below the mean size measured on the circumference, and on the same wheel must not vary

FIG. 14.—BOTTOM DROPPED.

more than 1-16 of an inch in diameter. The depth of white iron must not vary more than ¼ of an inch around the tread on the rail line in the same wheel, and must not exceed one inch, nor be less than ½ inch,

in the middle of the tread for wheels weighing 600 pounds; and shall not exceed one inch in the tread nor ½ inch in the throat for wheels weighing 700 pounds. Any individual wheel not conforming to the standard design and measurements, under weight, or having any of the physical defects noted, will not be accepted. For each of the 100 wheels which pass this inspection, two are selected at random, one of which is subjected to the drop test. The wheel is placed flange downward on an anvil block weighing not less than 1,700 pounds, and is struck centrally on the hub by a weight of 200 pounds, which receives ten blows falling from a height of nine feet for a 600-pound wheel, and twelve blows from a height of 10 feet for a 700-pound wheel. If the wheel withstands this test without breaking, it is subjected to the thermal test. The wheel is laid flange down in the sand and a channel way 1½ inches wide and four inches deep is molded around it with green sand. The tread forms one side of the channel way, and the flange as much of the bottom as its width will cover. The channel way is then filled to the top with molten cast iron which must be hot enough when poured, that the ring which is formed, when the metal is cold, shall be solid and free from wrinkles. Two minutes after pouring an examination of the wheel is made, and if found broken, or if any cracks in the plate extend through or into the tread, the 100 wheels represented by the test are rejected. In the case of the drop test, if the wheel breaks with less than the required number of blows, then a second is taken from the same lot and tested, and if unbroken, it is optional with the inspector whether he shall test the third wheel or not. If he should do so, and the latter withstands the test, the 100 wheels are accepted as filling the requirements of the drop test. It is further specified that the wheels must not vary more than two per cent from the required weight.

Notwithstanding these requirements the foundry losses in the most modern plants average less than one per cent, although two per cent is considered normal, and losses ranging from three to five per cent are not considered in keeping with the best practice.

Shrinkage from a Founder's Point of View.*

BY W. ROXBURGH, KILMARNOCK.

This subject may be said to cover all branches of mechanics, but nowhere does it lead to more difficulty than in the case of metals used in the art of founding.

But in proceeding and in order to extend a little, shall we say, on the philosophy of this subject which we trust will be to profit, and for this purpose if we turn to nature's schools, in the vegetable class, we shall learn much on this question, as there the influence and work performed by the variations of atmospheric temperature are clearly demonstrated.

Many of the common flowers of the field expand under the warmth of the summer sun only to shrink or contract with the cool of the evening.

With dams, bridges, embankments and railways, besides all mineral and metal things which are produced by founding or otherwise, the evil effects of shrinkage have to be guarded against. Hence, it is common knowledge to say that some clay goods call for as much as one inch per foot allowance for shrinkage. Indeed, musical instruments which produce their sounds by reeds give much trou-

*Paper read at British Foundrymen's Association at Middlesbrough, Aug., '06.

ble at times to the performer by "flattening" when played under excessive temperature, such as we experience in the excessive heat of a summer day. However, be that as it may, our purpose at this time is to deal more directly with what takes place with the shrinkage of metal from a founder's point of view.

Therefore, we confine our remarks to what most concerns, in a general way, the intelligent founder. Still in connection with this it must be admitted that no one can study the science of metallurgy to profit in a divided sense by taking one branch only; this we believe to be an impossibility. Hence the founder who keeps his mind open to study the phenomena of shrinkage which daily confronts him in his vocation of casting metals, coarse or fine, such an one is being educated in this subject in a manner not given to mechanics as a whole.

The losses occasionally amongst our engineering craftsmen and others for want of a knowledge of the laws of expansion and contraction have been at times demonstrated to us in practice. Many are the instances experience could give but prudence forbids, but take the case of a double beat valve whose different parts are cast of different metals, such as gunmetal and iron, each of which in their habits of expansion and contraction are altogether different, and, when exposed, to the same heat while working, results very unsatisfactory must happen for want of uniformity of expansion with the different metals of which these parts of the valve are cast; under such conditions of heat the valve face becomes faulty and cannot act with the precision which goes to make a good valve.

Consequently, in all constructions that are exposed to heat, these must as far as possible be cast of the same metal so that absolute uniformity of expansion and contraction of all the different parts will move in unison. The importance of this, no one can overestimate in any form of constructional engineering, and the branch of engineering that does not necessitate a knowledge of the laws of expansion and contraction as a cardinal point for good workmanship is not known to the man of experience.

Therefore, we may take it that all metals move with the rise and fall of the thermometer.

Thus it is that railways are constructed with ⅜ inch or thereby of clearance at each end of the 18-foot lengths to admit of easy expansion and contraction, and who can tell but much of the unaccountable loss and appalling disaster the world over, which from time to time befall humanity, may or may not be due to either of these two forces by something having contracted out of place, or perhaps staved up some point by expansion? But, enough of this, we pass on to the everyday work of a founder, and let us say advisedly, if he be wanting in knowledge of the phenomenon of shrinkage as it applies to his business, such an one will find his losses greater than those of the man who has acquired a knowledge of the subject.

Again, design and proportioning of thickness are important factors, and specially are these so with metals of all kinds. Properly proportioned thickness gives uniformity of shrinkage, uniformity of shrinkage creates elasticity and elasticity ensures strength.

It is specially worthy of note by those whose duty it is to design to see that they keep clear of objectionable angles when designing for the foundry. Because, that which might prove a first class design for constructional work would as likely as not mean irretrievable loss in the foundry, through irregularity of shrinkage.

So much for the philosophy of shrinkage to a molder, we pass on to what more concerns the practical founding of heavy castings and their behavior while some of their parts are passing through the plastic or second transition of shrinkage, the point

at which all shrink or vacuum holes are begun and ended.

It is generally admitted that all metals shrink in proportion to their density, and are influenced by thickness as to the maximum or minimum of shrinkage. Thus it follows that cast iron with its high percentages of carbon, which at times may be as high as four per cent shrinks less than other forms of iron containing less carbon.

Cast steel which is a product of iron and containing considerably less carbon, shrinks much more than cast iron, but neither of the metals have absolute fixity of shrinkage because of their variation in specific gravity. The more graphitic iron is, the softer it becomes and consequently the lowest shrinkages are associated with the softer brands.

With mechanics, as a rule, shrinkage is looked upon as an external force, but the founder knows that its effects lie deeper, for, to him his troubles are many from its internal action as well. Consequently he regards shrinkage as an integral force closely connected with what are variously known as "Draw," "Vacuum Holes," "Segregation" and not infrequently by the misnomer, "Blowholes" which last word introduces perhaps the most debatable term of all. The writer's opinion is that none of these terms expresses internal shrinkage so clearly as the one "Disintegration" for, whether it be clay, concrete or metals, disintegration is an act of breaking up or tearing the integral part or parts of those bodies by atmospheric influence, each atom or part following the lines of least resistance.

In heavy castings the textural construction of metal is seen in its crudest and roughest form, and by examining these we find the key to the question of internal shrinkage. Hence, with the softest or hardest of irons the gradiation of density becomes very apparent for, from one inch until we reach as high as seven inches thick (which by the way was the thickness of the old cast iron Bramah Press) we nearly, if not altogether, reach the disintegration stage. It has been observed on breaking up these heavy metal castings, that the texture is so rough that by the aid of a pocket knife applied to the torn condition of the "break" small pieces of graphite, or what is more technically termed graphitic eutectic (the graphite having separated itself from the iron) could be plucked out quite easily. This proves that with increased thicknesses, such as referred to, there must be a proportionate deterioration in the strength of metals so affected, clearly brought about by internal shrinkage, and as a matter of fact what applies to such heavy pieces as the "Bramah Press" the same in a greater or less degree applies to all heavy castings.

This, again is intensified at junctions or attachments, where internal shrinkage develops into integral disintegration, but, as a rule those unsound junctions only reveal themselves while under the test of the hydraulic ram. In short, our knowledge in the shrinkage of metals will only be in proportion to our understanding of the three transitions. First, from the fluid state to the plastic, second, from the plastic to sherry red solidification and third, from this state of semi-solidification to that of absolute shrinkage which is atmospheric temperature.

We now pass to the consideration of the shrinkage of metal causing warping or twisting, due to unequal cooling. In this matter it is not so much a case of unequal distribution of metal as a question of conditions relative to the position of casting. Certain articles have a tendency to twist in cooling, but if turned upside down in casting the result would be quite different. For example, take for our pattern a casting of a U. V. section and of equal metal. First cast with the bottom down, the bottom side of this casting will remain hot considerably longer than is possible with the sides and, as a matter of fact, both ends would incline downwards, and thus concave the casting. Next mold

a second one from the same pattern, but with the bottom upwards, with the result that what was formerly the hottest part of the casting, is now more exposed to the atmosphere, and, consequently brings about a better uniformity of cooling, a result much to be desired, but at times a practical impossibility. There is no absolute rule of guidance in this branch of founding, everything cast has its own peculiarities in cooling, and nowhere do we find the trouble of warping more pronounced than by the shrinkage of light and hollow castings. Still, with such uncertainties, if we remember that heat in a general way draws towards its center and the extremities of the same body will at the same time turn inwards, concaving of U-section castings will inevitably follow when the face of the same is cast downwards. Thus it is that camber in the bedding down of sole plates and bearers of the U-section and bedding in the position as mentioned above, requires to be deflected in the middle so as to bring those castings straight from the sand.

In this connection the responsibilities between founder and pattern shop is frequently disputed, and whereever this is the case it ought to lie with the founder to decide the question.

It is obvious that castings of the hollow type, whose average thickness of metal may approximately be put at ¼ inch thick, do not lend themselves to the troubles of shrinkage attending the production of thicker metal castings. Because, if there be a plastic condition in light work, it must only be of momentary duration; consequently no irregularities of shrinkage from integral "draw" as is common in heavy metal castings, can possibly take place.

However, those engaged in hollow work may think they have plenty to contend with in warping, a trouble in shrinkage scarcely known to many heavy metal workers.

Thus far we have dealt with our subject in three divisions, namely, the philosophy of shrinkage from a molder's point of view, secondly, shrinkage of heavy metal, and thirdly, shrinkage of thin metal and its tendency to warp.

However, there is but one point more which ought to command the attention of practical men, and that is the tendency in these days of designing so many different parts which at one time formed separate castings, but now are cast all in one piece quite regardless as to how shrinkage may affect them in cooling.

Although the difficulties of founding be multiplied, we do not grumble, but what we have to do is to let those responsible for such troubles understand that such complications involve much risk to the founder and in that way our risks of loss as indicated may be reduced to the lowest possible by a good understanding between the drawing office and foundry.

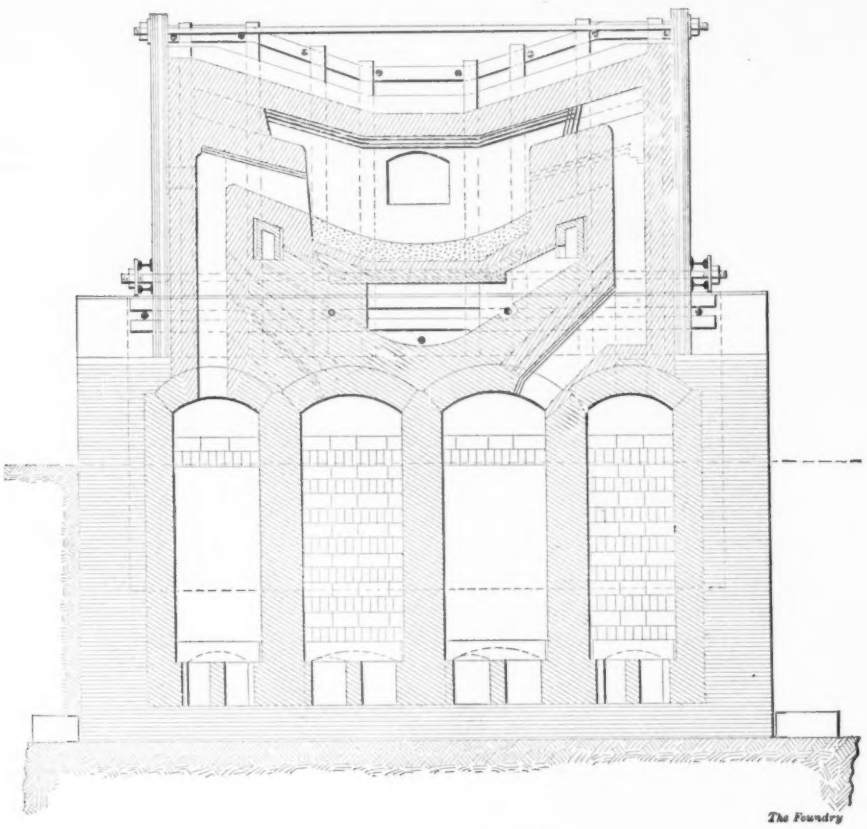
Again, in connection with shrinkage and metal treatment, or more correctly, the tempering of castings, there is abundance of material for inquiry on "cause and effect of shrinkage in castings" which may have been too soon or too late lifted from the sand, with the former by a premature exposure to the atmosphere, external shrinkage must considerably develop before internal shrinkage has properly begun, and is aggravated when valve seats and other internal adjuncts in effect consign a casting thus treated to a short life, if nothing worse happens through such unguarded treatment.

Castings that are to be polished but otherwise plain, even when cast with iron above the average density and price, if left too long in the sand bring on decarbonization, and instead of getting a polished casting with a bright lustre, we get a dirty speckled like article, an eyesore to the founder, and a short lived article to the buyer, i. e. if it belongs to the anti-frictional grade of castings. Thus a poor and cheap brand may be improved and a superior and costly one spoiled.

The interest involved in "Keep's

Curves" which is another phase of this subject relative to the "three expansions" and recently confirmed by Professor Turner, is worthy of all possible investigation, for truly there is much wonderful phenomena in the habits of metals; and the variation of results in practice, by the different methods of cooling is complete proof of anything such as brick, loam, hard dry sand, core irons, or any other adjunct pertaining to a mold that is in any way likely to impede progress.

Lastly, the multifarious phases of shrinkage and its treatment to avoid loss from springing, bursting or warping, is at times somewhat difficult of explanation; for whether it be camber.



A RUSSIAN OPEN-HEARTH FURNACE.

of this assertion; indeed, no man can enter this field of research, and especially if he is a responsible foundryman, but will be repaid for all the trouble it involves and his means will be multiplied in the uses of the metals, which is a cardinal point in all branches of founding with metals, and metalloids of every description.

Further, the practical side of the question may be summed up thus:

Slacken internally and externally, wherever there be the least indication the exposing of heavy parts, the application of cold water (such as in the cooling of bosses), the splitting of same in two or three places, the running of metal in a gutter round the outside of a pulley or similar article, or the casting of pieces on for maintaining uniformity of heat throughout the process of cooling a casting, and which have to be machined off afterwards all revolves on the one idea of uniformity of cooling.

If we could get this together with

no impediments in the process of shrinkage, neither warping, concaving, convexing, breakage or burst of any kind would be possible, but just on account of those evils depicted here which belong to external shrinkage not to mention the all important and vital question of internal shrinkage, proves this subject to be of paramount importance to all users of metals in the art of founding.

DESCRIPTION OF A RUSSIAN OPEN-HEARTH FURNACE.

In these days of large units and tonnages it is interesting to pause in our study of the problem involved and note what is being accomplished in Europe with small equipment. The cut given herewith shows the lines of an acid open-hearth furnace of one ton capacity and capable of being enlarged to 1½ tons. The hearth area is only four feet by five feet seven inches. The furnace is in successful operation by a concern engaged in the manufacture of agricultural machinery and some smaller parts used in mining appliances, located at Berdiansk, an important grain shipping port on the Sea of Azov. The fuel is producer gas made from a low grade slack coal which yields only 37½ per cent of gaseous matter and leaves a heavy residue of ash. The same coal is briquetted and used as a source of heat in firing annealing furnaces.

The interesting feature is that the furnace is used both in malleable iron and steel melting, frequently alternating between the two, and it is possible to make three heats per 24 hours of either kind of metal.

The shop is not fitted with crane service, all the pouring of the metal being done by hand ladles, going into machine made green sand molds. In no case do the castings exceed 750 pounds each.

The molding sand is a white quartz bonded with kaolin and tempered with a solution of a by-product from a sugar factory (no doubt molasses.) In this particular the practice is not far from that of our leading steel foundries in the United States.

The contrast between a Talbot 200 ton furnace and the furnace in question is striking. With the possibility of rich fuels as found in the United States, together with many available grades of melting stock, it might be ventured that a small O. H. furnace of similar lines and dimensions slightly improved might meet a need in this country where the demand for small steel castings is constantly increasing.

The writer is indebted to Jno. E. Greaves, Esq., president of the concern, for the courtesy of the furnace drawing and description.

W M. CARR.

GRINDING WHEEL TESTS.

The National Corundum Wheel Co., of Buffalo, N. Y., has sent us a record showing tests made upon a series of their wheels at Cornell university, the results of which are shown in the accompanying table:

Record of Tests of National Corundum Wheels.—Made at Cornell University.

No.	Size. Dia.	Thick.	Hole.	Rev. per Minute. Rated.	Broke.	Peripheral speed. Rated.	Broke.	Time. Run.	Factor. Safety.
1	24	2½	1¾	850	2,359	5,335	14,800	32 minutes	7.71
2	24	2½	1¾	850	2,398	5,335	15,060	128 minutes	7.97
3	14	2	1¼	1,500	5,600	5,499	20,510	31 minutes	13.83
4	14	2	1¼	1,500	5,330	5,499	19,520	34 minutes	12 6
5	14	2	1¼	1,500	5,675	5,499	20,420	27 minutes	14.29

There was insufficient speed at the university to break 12-inch wheels. Wheel No. 2 was started at 1,540 R. P. M. and speed increased every five minutes breaking at 2,398 revolutions after running 128 minutes.

BRASS FOUNDING

THIS DEPARTMENT IS DEVOTED TO THE TREATMENT OF ALL ALLOYS INCLUDING THEIR

FOUNDING, GRINDING, POLISHING, ELECTROPLATING ETC.

BRASS CASTINGS.[1]

By J. L. Jones.[2]

The art of the brass founder dates back beyond the dawn of history. It is probable that the first brass founder made his mixes by what may be called "the direct process," mingling the copper, zinc, tin and lead ores together and reducing them with charcoal, pouring into ingots and remelting. Quite a variety of alloys could be made in this way but unless the ores were very pure, many objectionable impurities would be introduced. The Japanese and Chinese at the present time cling to these antiquated methods in some localities but so great is their skill that fine results are obtained. The writer some time since made an examination of a Japanese bronze lantern that was a beautiful piece of work. The top of the lantern was a circular plate 5¾ in. in diameter and only 1-16 in. thick. Its upper surface was profusely ornamented and every detail was so distinct that it showed that a very fine grade of molding sand had been used and that the bronze was very fluid when melted. The casting was rather brittle but it had a beautiful patina or surface color. Its composition was as follows:

Copper	80.25
Lead	6.55
Tin	2.12
Zinc	nil
Iron	.14
Arsenic	9.17
Antimony	1.91
Nickel	.45

A bronze of this character could hardly have been made from ingot metals.

It has been charged that the modern brass founder is not progressive and that he clings to antiquated methods. This is hardly true in the United States and there are few industries in which there has been as much improvement in the last ten years as in brass founding.

A typical brass foundry of the "old school" in a neighboring city was visited by the writer recently and the following description of it will afford an opportunity of comparing it with the modern brass foundries. The foundry in question was about 30 feet by 20 feet and employed two men in addition to the proprietor. There were two crucible furnaces and a heat of 1,200 pounds could be poured. The core-oven was an old cook stove and coke was bought by the wagon load, while the molding sand was dug from the neighboring lots. This brass founder knew how to make solid copper castings, he could put 30 per cent of lead into a casting without it separating, and do other stunts of this kind that are supposed to mark a man as up-to-date, but he realized that the time was not far off when he could no longer compete with a modernly equipped brass foundry and was preparing to retire from business, and enjoy the comfortable fortune he had made.

At the present time brass foundries often rival iron foundries in size and equipment. In most of the larger plants, crucible melting has been supplanted by the use of oil-burning furnaces of the Schwartz and other types with the result that the melting is

[1]A paper read before the Pittsburg Foundrymen's Association, Jan. 7, 1907.

[2]Metallurgist Westinghouse Electric & Mfg. Co., Pittsburg, research department.

done for about one-half the cost of crucible melting and the melting losses are only about one half the losses experienced when crucibles are used. To obtain these results, experience and careful handling are required. Any alloy or metal used for making castings from copper down to aluminum or zinc can be successfully melted in an oil melting furnace, and the use of such furnaces is one of the most striking advances that has been made in brass foundry practice in recent years.

Molding Sand.

In the making of brass castings, the selection of a good molding sand is of first importance, and should be chosen to suit the work in hand. Brass sands as a rule differ little if any from the sands for making iron castings. If anything they are rather inferior to iron molding sands. Brass having a lower melting point than cast iron requires a less refractory sand and considerable amounts of mica and other slag forming materials may be present in a brass sand, especially if the castings are light. The Philadelphia sand, for instance, gives very good results with light brass castings but it contains so much clay and mica and is much esteemed by many brass founders. The well known French sand used for statuary work surpasses all molding sands in toughness and "body" although both its chemical and physical composition differ but little from that of standard Albany sand. Possibly the unusual qualities of French sand are due to the great plasticity of the clay which bonds its grains together.

Below are given a number of chemical and mechanical analyses of typical brass sands, the mechanical analyses being made by Hilgard's method:

The high price of the French sand renders its use prohibitory for most work. The rather large amount of lime in the two samples given above is noteworthy.

Some brass founders make a practice of adding common salt to the water used for tempering molding sand, using about 4 ounces to a bucket of water. The only advantage derived from the use of salt is due to its taking up moisture and making the sand stick together, so that it will not wash before the molten metal, and hence give a smooth casting. The use of much salt will prove detrimental as it adds a fluxing ingredient to the sand and makes it liable to burn on a casting.

Chemical Analyses.

Name.	Ignition.	Silica.	Alumina.	Iron Oxide.	Lime.	Magnesia.	Potash.	Soda.
Philadelphia	4.00	71.60	11.49	7.81	.65	.95	1.42	1.27
Albany	2.50	81.45	7.30	4.10	.90	.68	1.40	1.38
French Statuary	2.65	85.08	5.10	4.00	1.20	.25	1.28	.34
Mild Lumberton	3.25	86.80	3.05	5.32	.15	.65	.83	.04
Strong Lumberton	3.10	84.28	4.50	6.10	trace	.72	.91	.39
Millville Gravel	2.20	87.00	6.70	3.20	nil	nil	.25	.65
Poor Gravel	8.05	65.10	17.65	7.90	.50	nil	.70	.02
Charlesville French	2.81	81.26	5.69	4.29	4.34	.36	.87	.38

Mechanical Analyses.

Name.	Pebbles.	Coarse Grits.	Fine Grits.	Coarse Sand.	Fine Sand.	Coarse Silt.	Fine Silt.	Clay.
Philadelphia	nil	nil	.37	.61	70.97	9.27	13.63	4.05
Albany	nil	nil	.36	6.98	49.80	35.42	3.25	2.07
French Statuary	nil	nil	nil	4.40	44.05	28.64	18.56	3.77
Mild Lumberton	nil	5.45	14.55	29.90	31.50	8.95	6.35	3.15
Strong Lumberton	nil	6.95	18.45	38.40	19.20	6.25	7.40	3.20
Millville Gravel	.05	49.15	28.35	7.05	1.40	7.80	2.20	3.75
Poor Gravel	18.60	4.40	5.30	4.80	6.00	19.30	6.70	34.90
Charlesville French	nil	nil	nil	.20	67.74	16.03	12.58	2.87

Metal Used for Making Brass Castings.

Of the metals used in making brass castings, copper, tin, zinc and lead are the most important and they rank in the order named. Other metals, such as aluminum, nickel, iron, manganese, antimony and magnesium are some-

times used, as are the metalloids, phosphorus and silicon.

Copper.—Copper is generally used in the ingot form. As the best brands of lake copper are largely bought up by the wire makers, electrolytic copper has to be used now by many founders who would much prefer the lake copper. The best grades of electrolytic copper are, however, equal to, or superior to, the best grades of lake copper. Among the best brands of lake copper may be named the Calumet and Hecla, Quincy, Tamarack, Osceola, etc. The Batlic, Champion and Trimountain were once ruled off the New York Metal Exchange for arsenic content but it was only for a short time and these brands are as good as any for brass castings. Some buyers think that nothing will do for their work but Calumet and Hecla, not that it is any better than other brands, but being a large producer its copper is of uniform quality and the buyer gets used to the product and will have nothing else.

Among the best electrolytic brands are the Copper Queen, L. N. S., O. E. C., D. R. W., P. A. C. and M. O. C. O. C. O., but it is only necessary to use these when making copper castings. For ordinary work, scrap wire or strap, or the common grades of casting copper, may be used. Scrap wire could be used for copper castings if it were not for the soldered ends.

The best method of ascertaining the purity of copper is by taking its conductivity. High grade lake and electrolytic copper runs very close to 100 per cent conductivity and analyses 99.9 per cent copper. The Westinghouse Electric & Manufacturing Co., uses the apparatus shown in Fig. 1, for testing the conductivity of its brass mixtures, copper, etc. It is both suitable for testing metals that can be drawn into wire, like copper and others that cannot be forged, such as red brass, etc., while it is rapid and sufficiently accurate for all practical purposes. The board carries three standard rods of ¼-inch diameter, which are made of copper, brass and German silver and have a conductivity of 100 percent, 20 per cent and 1 per cent, re-

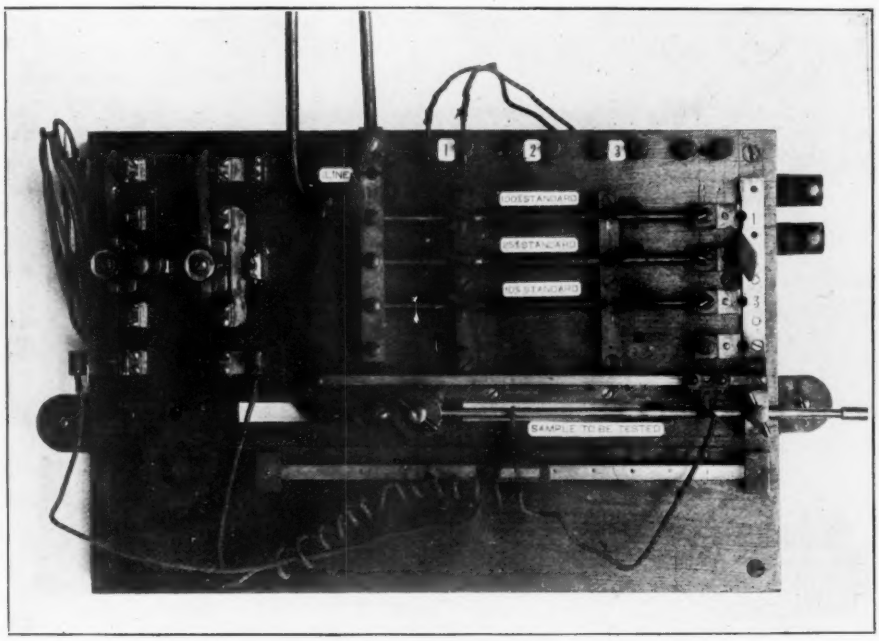


FIG. 1.—TESTING BOARD.

spectively. The rod to be tested must be of similar diameter to the standard. It is balanced against the standard and its conductivity read off on the scale. In addition to the board, an ammeter and voltmeter are required. In testing copper an ingot is taken at random from a carload lot and forged into a bar about ½ inch square by 12 inches long. This is annealed and a rod of the required ¼ inch diameter turned from it and tested as above. No corrections for temperature have to be made. Tests are made on brasses and bronzes that are not forgeable by casting them into ingots or rods and turning these down on a lathe, provided with a support to keep the rod from buckling.

The conductivity of annealed copper is about two per cent greater than when it is hard drawn or hammered cold. A specification that required high grade lake or electrolytic copper to have a conductivity of ninety-seven per cent hard drawn and ninety-nine per cent annealed would shut out all inferior brands. Casting brands of copper for ordinary work could be bought on a basis of 99.5 per cent metallic copper.

Tin.—This metal has been increasing in value so rapidly that all brass makers are hunting something to replace it. Straits tin is the best and perhaps in the long run the cheapest that can be bought. There are various brands of cheaper qualities of tin on the market. The Lamb and Flag brands produced in the south of England mines have a good reputation and next to Straits are to be preferred because free from antimony and arsenic. Bolivian tin contains, as a rule, too much antimony to be used for castings but it may be refined to a high degree and rendered more acceptable. The various brands of Straits tin are practically all alike and they are said to be smelted by a single syndicate so that it matters little whether the pigs are branded Penang, Behn-Meyer & Co., Gelfillan-Wood & Co., or whatnot.

Spelter or Zinc.—The brands of zinc known as prime western spelter are good enough for most classes of brass castings, as they seldom contain more than one and five-tenths per cent of lead and only traces of other impurities. In some government mixtures that require unusual strength, Butha and similar grades of zinc that are free from lead must be used. Slabs of zinc that have a fine grain may be suspected of having been made from kettle-refined dross and of containing considerable iron. There has been recently put on the market several brands of zinc that are made from the direct distillation of galvanizer's dross. Some of this zinc is extremely pure but it has not found a very ready market because a much higher price is asked for it than prime western spelter brings. Among the brands of this zinc may be mentioned M. H., Premier, Solar, and Golden Rod.

The brands of western spelter are quite numerous and nearly all of them run about the same in quality. Among the brands may be mentioned Lanyon, Granby, Sandoval, Illinois, A. B. C., and Rich Hill. They are made from ore.

Kettle-refined spelter is often of excellent quality, even though made from galvanizer's dross. When double refined, it is superior to prime western spelter. The diamond "S" brand is especially of good quality.

Occasionally when prices are high a little Silesian zinc is imported but it is in no way superior to prime western spelter.

Lead.—It is generally thought that all brands of soft lead contain only traces of impurities and are equally good. But brass founders who watch their losses carefully will find that the melting loss on some brands is only about ¼ of one per cent while on others it may exceed three per cent. Some brands are made from argentiferous or silver bearing ores and others from non-argentiferous ores. The brands known as "Chemical leads" usually give the most loss in melting. Freedom from dross and oxides rather than analytical purity is what the founder wants in his pig lead.

Among the brands on the market may be mentioned Federal, Granby, St. Joe Picher, etc.

Brass Mixtures.

Mixtures for brass castings are so numerous that one can only touch the high spots in speaking of them.

Red Brass.—Of the mixtures of red brass that are in use, few if any can compare with the well known "88-10-2" for all around excellence. This consists of 88 parts of copper, 10 of tin and 2 of zinc. For general fittings, machinery castings, valves (especially large valves), condensers, steam pipes, etc., it gives very good results, as it is strong, tenacious and runs well in casting. For government work this mix is required to be free from lead, as lead greatly decreases the tenacity of castings both when they are cold and hot. Lead is usually supposed to be added to brass mixtures in order to make the castings machine easily. It does this because it decreases the strength of the metal. The quality of brass castings would be greatly benefited if lead were banished from the brass foundry entirely, although there are some bearing bronzes in which its use may be necessary.

Yellow Brass.—The government mixture of 67 parts copper and 33 parts zinc is about as cheap a yellow brass mixture as any. Its running qualities are improved by a little tin which also stiffens it up for it is rather soft. It is the practice in some localities to add aluminum to both red and yellow brass in order to improve its running qualities, but conservative brass founders prefer to keep aluminum out of their foundries, especially where castings have to stand an air or water test.

Scrap.—Where no strength is required, scrap can be used to advantage and it is customary to load it up with all the lead it will stand in order to cheapen the product. Scrap if free from iron is really better than new metal as far as uniformity is concerned, because the remelting amalgamates its constituents and thus improves it.

Phosphor Bronze.—Phosphor bronze usually consists of copper, tin and phosphorus, and it is an unwritten law that zinc must be kept out of it. In some foundries phosphor bronze is made by throwing a small stick of phorsphorus an inch or two in length into a crucible of metal, when it is brought from the furnace. The phosphorus floats about on the surface and burns, doing the metal little if any good. Others go to the opposite extreme and use from 1 to 2 per cent with the result that segregation and blowholes occur in the castings. One pound to the hundred will usually thoroughly deoxidize the metal unless it is very dirty. Phosphor-copper is much to be preferred to metallic phosphorus, as the latter is uncertain in its action and dangerous to handle. It may be rendered less inflammable by putting it in a solution of blue-stone and thus coating it with copper. Phosphor-copper may be had on the market up to 15 per cent phosphorus, and it gives a stronger, tougher, more uniform alloy than when phosphorus is used, and the sand does not burn on the castings to such an extent.

The standard mixture for bearings consists of copper 79.70, tin 10, lead 9.50 and phosphorus 0.80.

Lead Bronzes.—Various mixtures which contain as high as 30 and even 50 per cent of lead are being recommended and used to some extent for bearings. They do not give as satisfactory results as standard phosphor bronze, being deficient in strength. This lack of strength combined with lack of ductility causes the bearings to flake. These alloys also are difficult to handle in the foundry.

Copper Castings.—What are called "pure" copper castings are usually required for electrical use and must not only be sound castings, but possess high conducitivity also. Both these requirements may be attained by casting high grade electrolytic copper into metal molds, but this method can only be used where the castings are plain and wanted in large numbers. In most cases the castings must be made in sand, and this renders it necessary

to add some deoxidizer to the molten copper in order to secure a casting free from blowholes. If an excess of the deoxidizer is added, the conductivity is lowered. Silicon has proved the best material to use, but on account of its high melting point it is added preferably as silicon-copper containing 10 per cent of silicon. The makers of copper castings should make it a rule to select one brand of copper and use no other, for the more brands he uses the more variables he introduces into his practice and the less likely is he to obtain castings of high uniform conductivity.

Manganese Bronze.—There is a large and increasing use of this alloy for automobile castings, and other sections where cast brass is not stiff enough. The making of castings from manganese bronze offers no especial difficulty if it is remembered that its shrinkage is unusally high. It runs well and thinner castings may be made from it than from yellow brass. On account of its great strength, the weight of castings may often be cut in half by using it instead of red or yellow brass. On account of the large amount of zinc it contains it is liable to run scruffy, and for this reason it is necessary to bottom-pour all castings. The mixing of manganese bronze is a difficult operation and it is best for the small user to buy his ingot. A number of brands of manganese bronze are on the market, some of them being of excellent quality and others far from satisfactory.

Ventilation.—The tendency in present foundry practice seems to be toward brasses containing more and more zinc and toward the use of oil melting furnaces instead of the old crucible furnace. The aim in all oil melting furnaces is to obtain perfect combustion, producing the maximum heat from the oil consumed. When this is done only carbon dioxide gas is discharged from the furnaces. This gas is not poisonous in the ordinary acceptation of the term, except as it vitiates the air of the foundry. Under actual working conditions, however, combustion is far from perfect and large volumes of the very poisonous carbon monoxide gas are often discharged from the furnaces. The fumes of zinc oxide, which come from the furnace, and from the pouring crucibles, often give trouble in the winter season when windows have to be kept closed. Poisoning by zinc is known among the workmen as "spelter shakes." The symptoms that may be produced are coughs, stomach trouble, paleness and a dirty gray skin, with blindness at night and chills. After a time there is developed a kind of paralysis and tremulous movements of the body.

When a foundry is large and roomy the gases and fumes seldom give trouble. When possible they should be removed by down-draft ventilation, because both carbon monoxide and dioxide are heavy gases while zinc oxide and the other metallic fumes are heavier yet. Most of the larger brass foundries provide excellent wash-rooms and even shower baths. The men should never be allowed to eat their lunches in the foundry unless it is absolutely necessary. The hair, beard and nails should be kept short, so as not to take up the dust and respirators may be worn by the men pouring off. Shops that pour off continuously have to take greater precautions than those that pour off at 11:00 a. m. and 4:00 p. m.

MELTING IN AN OIL FURNACE.

By F. S. Fasig.

I have taken a keen interest in the articles which have appeared relative to the advantages and economy of what are commonly termed oil furnaces, that is, furnaces in which the metal is melted in the furnace chamber in direct contact with the flame.

In the article of the October, 1905, FOUNDRY by Mr. Webb, he questions the economy of melting yellow brass in this style of furnace, although he records the fact that he has been successful in melting red metal in such a furnace. The writer has had 23 years of experience as foundry foreman

making builders' hardware, and during this experience has had opportunity to compare various methods of melting as to their relative efficiency. In 1900 we tried oil as a fuel for a crucible furnace, but the large amount of fuel required and the small number of heats which can be obtained from a crucible (10 to 12) together with the high cost of maintenance of the furnace caused us to abandon this method of melting after giving it a thorough trial. We then returned to the old method, using coke and the ordinary style of crucible furnaces. In 1902 we purchased a tilting furnace which melted without crucibles. The success we met with at first was not satisfactory, but subsequently we became accustomed to its operation and were able to melt red metal at a loss comparing very favorably with our crucible practice, though we experienced more or less trouble in melting yellow brass economically in this furnace.

Early in the present year we purchased a double chamber melting furnace, using the exhaust heat from the active chamber to preheat the metal in the secondary chamber. From the first this furnace worked very nicely and as we became accustomed to its advantages we were able to get better and better results, so that we are now melting both red and yellow brass successfully. We have been successful in getting a heat of red metal from one chamber and of yellow metal from the other chamber if it was so desired, working the two chambers alternately, getting the metal of an even color and hot enough for the lightest castings. The consumption of oil is slightly more than 1¼ gallons per 100 pounds of melted metal. The loss on eight-ounce metal, that is, 33 1-3 per cent spelter and 66 2-3 per cent copper, in which the spelter is added eight to ten minutes before pouring, averages on new metal less than three per cent, but when using part turnings and scrap it varies, ranging from 3½ to five per cent according to quality.

Our saving in coal, crucibles and maintenance amounts to considerable and is shown by the following statements: We use No. 16 crucibles, from which we can pour 12 to 20 molds, as our work runs quite light. In using such a small crucible, the fuel cost when melting in an ordinary furnace is much higher than when using larger crucibles, but owing to the fact that our metal must be hot and that our molds are small, we have found this size the best adapted to our work.

Since we have commenced using the oil melting furnace, we use the crucibles for pouring only, and to heat them previous to pouring the metal into them have arranged an oil furnace which uses oil and air in the same system that supplies the melting furnace. This crucible heating furnace holds 10 to 20 No. 10 crucibles at a time.

To melt 2,750 pounds of metal in crucibles requires 3,360 pounds of coal, or 1.22 pounds per pound of metal melted with coal at $4.50 per ton. This is equivalent to a cost of 24.4 cents per 100 pounds of metal melted. The crucibles cost $1.00 each, freight included, and last an average of 18 heats of 40 pounds per heat, or 720 pounds of metal per crucible. This makes a cost of 14 cents per 100 pounds of metal melted for crucibles. Under the present arrangement, in which we use the crucibles for pouring only, they last for over 100 heats, thus making a cost of one cent per 100 pounds of metal melted for crucibles. The oil required to melt 100 pounds of metal, including that required for heating crucibles, averages less than 1½ gallons. This costs 4.1 cents per 100 pounds of metal melted. The repairs to the oil furnace we are now using cost very little, in fact, much less than the maintenance of a pit crucible furnace of similar capacity. We have melted over 400 heats from each chamber, averaging 500 pounds per heat, or 200,000 pounds of metal in the present set of linings, which are made of fire sand rammed around a form. The saving boiled down to a few statements is something as follows:

Coal, per 100 pounds of metal melted,		24.4 cents
Crucibles, per 100 pounds metal melted		14.0
		38.4 cents
Oil, per 100 pounds metal melted	4.1 cents	
Crucibles, per 100 pounds metal melted	2.5 cents	
	6.6	6.6
Net saving per 100 pounds metal melted		31.8 cents

Figuring on this basis, melting an average of 71,500 pounds of metal per month, the saving amounts to $198.77 per month.

CASTING BRASS ON IRON.

By Louis Luhrsen.

In the last few years it has become the custom among railway master mechanics to have brass bushings cast on throttle stems, rocker arms and fulcrum bars, in fact on any part of a locomotive which is worn in size and by casting a bushing on, will answer its purpose for many more days. They claim that two metals of a different kind, viz., steel and brass, wrought iron and brass, iron and babbitt, etc. will furnish a smoother wearing surface than two metals of the same kind will give, the latter also being subject to running hot, gaulding and cutting. In view of these facts I call attention to sketch, Fig. 1, which represents a throttle stem for a locomotive. It is made from the best of wrought iron obtainable but on account of it being worn from A to B requires a brass bushing cast around it at this point. The first stem we tried was an entire failure it was so full of blow holes (originating from the stem) that the bushing had to be turned off and the job done over again. We came to the conclusion that perhaps a light scale, a little rust or dampness was the cause of the blowholes. In order to avoid this, the stem was heated, cooled and a light cut taken off it in the machine shop. It presented a bright appearance without a spot or blemish of any kind, in this condition it was returned to the foundry. In casting the bushing on this stem we proceeded as follows: The stem was driven into the floor the desired depth (to make it handy for pouring) it was plumbed and the lower drag put in its place. On each side of the stem a two-inch round pattern of any desired length is bedded in. This stick brass answers two purposes. First, as a flow off, second it is used by railroad companies extensively for various purposes and is credited to

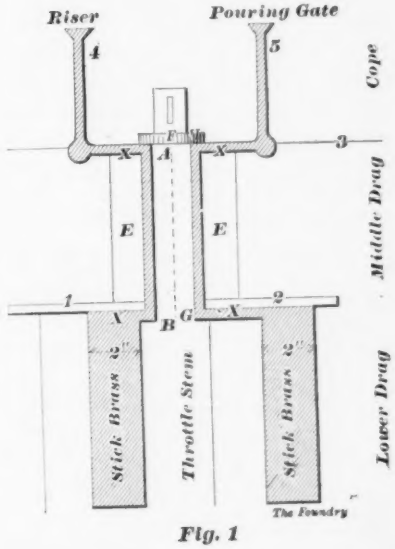


Fig. 1

the foundry the same as castings. The bushing mold proper is made in a dry sand core E which is made in two halfs and pasted together. A hole through the center large enough to slip over the collar F and extending as far down as G. The stem at F and G being of the same size the core naturally centers itself, thus insuring a uniform thickness of metal. Before this core is placed four gates have been filed in the same at XX, and a connection cut into the two-inch stick brass mold. We now draw the latter patterns from the sand and cover same with cores one and two. Our next move is to place in position the middle drag and ram it up to the point

three and make the usual parting, cover the top gates XX with a piece of card board, put on the cope and place gates four and five, then ram up and lift off, remove the card board, cut the connecting gates as shown, and the mold is ready. We leave the cope off until shortly before pouring.

These bushings are one-half inch thick and finish up without a flaw or blowholes. The formula for the mixture is copper, 80; tin, 5; lead, 5. It is understood that from twenty to forty per cent of scrap consisting of the same mixture can be used without fear.

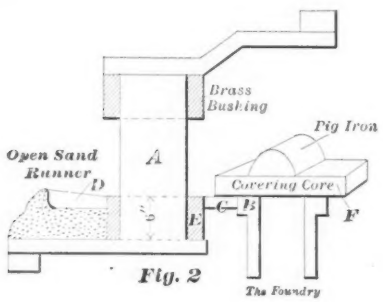


Fig. 2

The Foundry

A rocker arm for locomotives having bushings six inches long and one inch thick cast on it, is shown in Fig. 2. This arm is forged from wrought iron and the shaft A turned up bright and clean, like the throttle stem in Fig. 1. It is set on the floor leveled and plumbed. The pattern which is used in molding the bushing around the shaft is a shell pattern E, 1⅛ inches thick, split in halves lengthwise. The inside diameter is the same as shaft A and the outside diameter, whatever is wanted. This pattern is placed around the shaft and rammed up. A rod bushing pattern B is bedded in along side of it to serve as a flow off. The connecting gate C is cut and the pouring runner D is built up. The shell pattern E, is then drawn likewise B, covering the latter with a core F, which is held down with a piece of pig iron or some other suitable weight. The mold is then ready for pouring. The rod bushing B is used on driving rods and credited as castings. The molding of these bushings is open sand work and can be quickly done. The gates are broken off while the casting is hot. When the latter is cooled sufficiently the arm is turned upside down and the other end cast on in like manner. Formula, copper, 80; tin, 8; lead, 8, with fifty per cent of scrap of same mixture.

The metal for all jobs of this kind

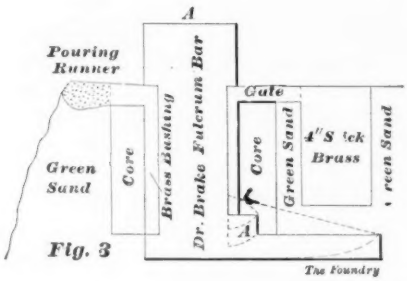


Fig. 3

The Foundry

should be hot and runners built to insure fast pouring. In connection with this subject I make mention of the the fact that the thinner these bushings are the tougher the metal should be or the result might be a casting cracked from top to bottom on account of the severe shrinkage Remember that a shaft or stem will not give away before the shrinkage like a core.

Fig. 3 is a driver brake fulcrum bar. The core for this bushing is made in two halves on account of the shoulder A which goes half way around the bar. This core is not pasted together as it is placed on the bar (not over) on account of the hole through the core being smaller than the top diameter of the bar at A. This core is held together, with binding wire rammed up and the mold made the same as the rocker arm. This bushing is only one-half inch thick and formula same as No. 1. In conclusion will say that cleanliness and hot metal are absolutely necessary to success in these operations.

BRASS FOUNDRY NOTES

BY C. VICKERS

A BRASS LINER FOR A PUMP.

Inquiry:—The writer, who is the proprietor of a small foundry and machine shop doing jobbing work, lately received an order for a pump cylinder lining to be made of brass. The finished sizes were bore 18 inches, length 27 inches, thickness 3-16 inch. We first intended to make the casting ½ inch thick, 30 inches long, with four lugs to fasten to the lathe face plate to facilitate finishing, and gate from the bottom, but wishing to determine the exact shrinkage and weight we made an open sand mold from our ring pattern 4 inches deep and made a trial casting. In making this trial casting we gated from one side, using a single top gate. We had the metal good and hot, but it did not flow evenly around the mold At this point we abandoned the idea of gating our casting proper from the bottom, as it did not seem feasible for the metal to flow upward from a depth of 30 inches. After weighing our trial casting we found the shrinkage correct, but the weight, which figured about 275 pounds, was more than we were prepared to handle from our one crucible furnace, our largest crucible holding 250 pounds. We decided to take 1-16 inch from both inside and outside of the pattern, making a thickness of ⅜ inch. This done, we rammed up our pattern, which was 8 inches deep, drawing up and keeping level at each ramming, until the required depth was reached and finished in the usual way, cutting four gates across the center of core to form a cross, and dropping the metal down the sides of the mold.

The casting, when removed from its bed, seemed good, with the exception of a depression or "cut," about ⅜ inch deep, where the metal dropped under each gate. After being chucked in the lathe and a cut started, we found holes to such an extent that we decided to scrap this casting and make another gated from the bottom and cast with metal at a high heat. In making the second mold, we rammed four dry sand gates leading to the center of the core into a 1¼ inch round runner. I hope that it is unnecessary to mention that the molding and melting was carried on in the most careful manner and I will say also, that previous to this we have had no trouble in making perfectly clean brass castings.

The metal for this casting was poured fast and at as high a heat as seemed possible. As a proof of this, when the casting was stripped off we found that the brass had eaten into the pores of the sand to such an extent that considerable chipping was necessary to remove that spongy rough surface brass founders are familiar with on castings that have been poured with very hot metal under high pressure. This rough surface, though not very pleasing to the eye, we have always found insured clean castings. Thus our confidence in this casting. When finished, our second casting was almost perfect at the top, but at the bottom, extending up about 20 inches, were many small holes. All scrap metal was used, covered with charcoal and fluxed with borax. It is the writer's idea that to make a casting of this class it would be necessary to employ a dry sand mold.

Answer:—The writer recently made two cylinder liners, the smaller of which was similar to the one described above. It weighed 258 pounds, when cleaned up and was run entirely from the bottom, two gates being used, and placed in opposite corners of the flask, and connected with the outer circumference of bushing, two crucibles being used to pour from.

It is always good practice to pour such castings with two pots even where they would run perfectly well with one, in order to avoid trouble with air holes, and such defects. In the case of the above bushing, the metal used was scrap, previously run into ingots to clean it of dross and oxide, two fertile sources of trouble.

The ingots were remelted under

charcoal at as low a temperature as possible, that is the metal constantly fed into crucibles so that it had no chance to get hot, until the pot was filled, when it was raised to the proper heat for pouring and a little phosphorus added to each pot, the mold being ready, was immediately poured, the metal being sent in as fast as the runners would take it.

The metal was melted in two No. 50 crucibles each holding 150 pounds of bronze, the casting was poured at a medium temperature, the metal being neither very hot or very cool.

It is a mistake in my opinion, to pour such castings so hot that the metal eats into the sand to the extent mentioned by inquirer, and it is unnecessary as the metal will run perfectly well at a lower temperature.

If however the casting is so thin that there is doubt about its running, I should use more gates. These bushings should be made in a three part flask, and very often it will be found more convenient to have the cheek in two parts, to facilitate handling when there are no lifting devices other than human, as it will be much easier to lower it over the core without danger of striking the same. This will also permit of a very thin casting being gated in three places at the bottom, the middle of cheek and at the top. A casting one half inch thick of the size mentioned can be run wholly from the bottom, using two pots.

In the case of trial casting mentioned by the inquirer the reason it failed to run, was because it was made in "open sand" that is a mold minus a cope there was therefore no pressure on the metal. Under such conditions bronze will not run well, as it does not possess sufficient fluidity.

In the December issue of the FOUNDRY the writer took up the subject of holes in such castings, in an answer to an inquiry, on paper mill rolls, and the remarks were based almost wholly on the metal as the source of trouble, this inquirer believed in pouring his castings with very cool metal, thus going to the other extreme. The sand is also often the cause of holes in liner bushings, as well as pouring too hot or too cool, holes easily come in such castings they seem addicted to them.

When the sand is close, of the usual brass-founders' grade, adapted to comparatively light castings, a bushing of the size we are considering is safest made in dry sand, using a facing, containing sufficient lake, or other sharp sand, to make it open and with flour for a binder.

The facing is backed with ordinary sand and at this point the mold must be liberally vented, so that the gases which have passed through the facing, can freely escape, this is a point that is often overlooked, the result being practically the same, as if there had been no facing used at all.

With a proper and open grade of sand however, it is not necessary to dry molds for brass any more than it is for iron. Most iron founders have at least two grades of sand, a coarse open sand for heavy work and a fine grade for the benches, and no molder would think of using the fine sand in making heavy castings because he knows it will not do the work.

The brass molder, however, is apt to expect too much of his fine sand. Once or twice a year he gets a much larger casting to make than is usual, and he forgets his sand is not adapted for it. He takes great care in making his mold of course, and then wonders how the holes got in his casting. It may be put down as a rule, that no amount of care in molding and no amount of venting, will make a fine close sand, do the work of a freer coarser grade.

The remedy is to make such castings in dry sand, as it is cheaper to do so, than to keep a coarse grade of sand on hand for such infrequent castings, because it is easy to mix up a facing, and not at all difficult to skin dry a mold, but it takes lots of time and energy, to mix and temper a sand pile, that is not used enough to be kept in condition.

The bushing the writer made was

cast in dry sand with the precautions stated, and turned up perfectly clean, our usual sand being of a very fine grade was too risky to use green.

With a No. 3 grade of "Albany sand" much larger castings of this type can be safely cast in green sand, and foundries equipped for such work, never think of trouble with them, but expect to get each one, perfectly sound.

In the case of the inquirer, his melting capacity was insufficient for such a casting, in order to have enough metal to pour, he pared down his pattern so fine that he would have to obtain an exceptionally clean and perfect casting to make a success of it.

When there is only one casting, or so to make, a liberal finish should be allowed, in this case one-half inch thickness was none too much. It would have been a different matter if there had been fifty or a hundred such castings to make, the pattern could then be, so, as to allow the least possible finish on the casting as the molding would have to be so studied and improved as to turn out the castings as perfect and as rapidly as possible.

PLASTER OF PARIS.

Plaster of paris is such a well-known article in foundries, that it needs neither introduction nor description.

It is used mostly for making "matches" or "oddsides," but it has other equally as important uses, that are not so generally known. Some of these uses other than the one mentioned, are duplicating patterns, making core boxes, " printing back" molds to obtain a fine surface on the castings, cementing cores together, and preventing run outs on wooden flasks.

In a recent article, on white metal patterns, the writer pointed out the advantage of using such alloys for obtaining duplicate patterns.

It is apparent, however, that the usefulness of white metal is limited by the size of the patterns, that it can be used only for comparatively small work, as its weight would be prohibitive for large patterns.

For example, suppose we have a bushing of say 12 inches in length by four inches in diameter, and we have a large number to make, and may never see the thing again. We could get two patterns in a flask, but are only furnished the regulation one. We look around for some means of duplicating that pattern the easiest way, of course, would be to turn one out of wood like the original.

But we may not be equipped for wood pattern making—few jobbing foundries are, then again this pattern might not be such a simple thing as a bushing, we are merely taking a bushing as an example.

Therefore the easiest and cheapest way of getting a temporary pattern, is to cast one. White metal we dismiss from our consideration as it would be too heavy, if cast solid, while aluminum shrinks too much and it is quite a job to make a shell pattern by coring out.

It is much easier to make it of plaster of paris, if you happen to think of it, few, however, do, as there are not many plaster of paris patterns in commission.

The mold is made as is usual for metal, except that the sand may be rammed extra hard as there is no danger of blowing or scabbing.

The pouring gate must be placed on the highest part of the pattern, and should permit the liquid plaster to fall straight into the mold.

In the case of the aforesaid bushing it is best to cast it on end, putting the sprue on top of the core print, it is also necessary to provide means for rapping and withdrawing the future pattern, as the plaster itself would break away during such operations.

The easiest method that suggests itself is to imbed a block of wood in the plaster. Wood, however, possesses the disadvantage of ultimately swelling and splitting the pattern.

I have found that a bolt with its

nut on is the best provision that can be made for handling plaster patterns.

The length of the bolt is immaterial, just so that it will reach through the plaster and allow its head to be sunk into the sand of the mold, so that the threaded end with its nut, is held in the heart of the plaster.

It may be necessary to secure the bolt in its position, with nails or wire, so it will not sag or drop out when the mold is placed in position for casting.

That part of the bolt extending into the plaster should be well oiled or greased to permit its being screwed out of the pattern leaving its nut securely embedded therein.

The plaster should be mixed by adding a little at a time to the required amount of water, constantly stirring meanwhile.

It should be made a thin batter, and when the cast is made it will require feeding until it sets, so plenty of plaster should be on hand.

This is due to the absorption of the water by the sand, and because of it plaster casts in sand are exceptionally free from all air holes, and if properly fed are perfectly solid.

The cast must be allowed sufficient time to harden before removal from the mold, and the next operation will be to clean it up, this is easily done by the aid of a soft brush and plenty of water taking care not to round off sharp corners.

The pattern should now be allowed to dry, it is not necessary to be bone dry merely hard enough to stand handling, and it may be quite damp, that does not hurt as we give it a couple coats of shellac, and when this is dried the pattern is ready for business.

For cementing cores, plaster is not a rival of flour paste, in sticking halves of cores together, but I have found its use advantageous, where two cores must be fastened together in a certain position, as in the case of valve body cores, etc., where a small tit or projection on one core, must be cemented into a recess in another. The plaster can be applied, and as it sets immediately, the cores will not shift from their position while drying.

For "printing back" plaster can be either used alone, or mixed with half its bulk of fine dry sand.

This is placed in a salt bag, and dusted onto the surface of the mold, lycopodium being dusted over this.

The mold is then closed on to the pattern and rerammed, "printed" molds should be skin-dried for safety, but they are also often "risked" green.

With regard to plaster as a preventative of "run out," I have seen many a casting lost that a few cents worth of plaster would have saved, and have congratulated myself on its use many a time, when on lifting of the cope of a poured mold, it was found that the metal had reached the joint of the flask, and, eaten its way along looking for a weak spot where it could gush out.

For work of this character the plaster should be mixed with sand about half and half, this should be made into a mud, with which all dubious places are well smeared.

In a short time it sets like a rock and sticks to its post like one, resisting all attempts of the liquid metal to burst through.

Of course "run outs" are not supposed to occur, but they nevertheless do, and when it's a wood flask it takes lots of luck, sand, energy, and often profanity to save the casting.

So when that anxious feeling comes take no chances but think of the plaster.

A SUCCESSFUL THERMIT WELD.

We have received a letter from William Gebb, foreman of the United Verde Co.'s shops at Jerome, Ariz., telling of a very successful thermit weld which was made on one of its locomotive frames. This weld was made several months ago and is doing duty very successfully over a railroad 26 miles long, in which there are 190

curves, many of which are 45-degree curves with a three per cent grade. Such a road as this throws many severe strains on the frame and shows that a well-made thermit weld is capable of doing exceedingly good service.

BOOK REVIEWS.

"Die kaufmannische Verwaltung einer Eisengiesserei" (The Business Management of a Foundry), by Herrmann Winkler, 80 pages, 5 x 8 inches, bound with flexible buckram covers, published by Naucksche Buchdruckerei, Stallschreiberstrasse 5, Berlin S 14. German price, 5 marks, postage extra. This little book is devoted, as its title indicates, to the business management of a foundry. The author was for many years general accountant for Messrs. Ludw. Loewe & Co., Inc., of Berlin. The work contains many details and diagrams showing methods of cost keeping and accounting in the various departments of the foundry. It is published in German and of course the tables are made out for German standards, the weights being in the metric system and the price in German money. For those who understand German, however, it will prove a very interesting work.

Iron, Steel and Other Alloys, by Henry Marion Howe, L. L. D., professor of metallurgy in Columbia University, New York. Cambridge, Mass., Albert Saureur. 495 + xviii pages. 123 illustrations. 6¼ x 9½ inches. Cloth. Supplied by THE IRON TRADE REVIEW for $5.00.

This is the second edition of Prof. Howe's well-known work on the properties and composition of iron and steel. The older portion of the book has been revised and the errors, so far as they have been discovered, corrected. This portion of the work requires no comment.

The author in the second edition has added some new matter and rewritten a small portion of the old. The additions comprise the classification and definitions of iron and steel, which the committee, of which Prof. Howe was chairman, adopted for presentation to the International Association for Testing Materials; a description and discussion of the Roe mechanical puddler, the Mond gas producer and the Gayley dry-air blast process. The portion of the work which has been rewritten relates to the transition substances, martensite, troostite and sorbite. In view of the fact that the work is designed chiefly for students of engineering the author has treated these subjects as mechanical mixtures in varying proportions and varying states of aggregation of the three known primary substances, austenite, ferrite and cementite.

A New Pipe Shop.

The United States Cast Iron Pipe & Foundry Co. is rushing work upon its new plant at Scottdale, Pa., and expects to have it ready for occupancy early in the spring. The main building is to be 100 x 638 feet, with a 25-foot lean-to, running the entire length of the building. Two pipe cleaning sheds 400 feet in length and a cupola building are also being erected.

A New Steel Foundry.

The Delaware & Lackawanna Steel Co., with offices in New York, is repairing the old foundry and machine shop buildings donated it by the Oxford Board of Trade at Oxford, N. J., and will equip them for the manufacture of large and small steel castings. About $50,000 will be spent in remodeling and equipping the plant, and it will be several months before the work is completed.

Malleable Foundry Extension.

The Missouri Malleable Iron Co., East St. Louis, Ill., is increasing its producing capacity by the erection of a new foundry, 218 x 85 feet; two furnace buildings, each 40 x 45 feet and an addition to the tumbling and grinding department 75 x 100 feet. The foundry will be of fireproof construction, and the steel trussed roof will be supported on brick walls. Four 35-ton annealing ovens will also be added. These improvements will increase the company's total output to 25,000 tons annually.

GRADING PIG IRON FOR THE FOUNDRY.*

Purchase of Iron by Grade and Silicon Content Advanced as an Alternative to Buying Entirely by Analysis.

British Practice.

By P. Munnoch.

Although several schemes for grading pig iron by analysis have been proposed, the practice of buying to analysis for foundry purposes has made little headway in Great Britain.

This is due to some extent to the fact that no system yet proposed has been wide enough in its scope to suit the requirements of all branches of the foundry industry. Most of these systems have been based either on a fixed ratio of silicon to sulphur, or on a maximum sulphur, the grade being determined by the amount of silicon.

Owing to the extreme variations of the ratio of silicon to sulphur occurring in all grades of every brand of pig iron made, none of the methods proposed could include more than a small proportion of the irons now used in the foundries. The inevitable result of the adoption of such schemes would be the immediate increase in price of the iron sold to these specifications, as the majority of furnaces would be unable under present conditions to turn out half their make to suit the specifications. If they were able to do so and all iron made came within these specifications, it would be the greatest misfortune that could possibly befall the foundry industry.

Casting Requirements.

Different classes of castings require vastly different composition, and no scheme for grading by analysis, hitherto put forward is sufficiently elastic to suit all requirements. Founders making one class of work may require No. 3 iron with three per cent of silicon, but others making a different class of work may require No. 3 iron with one per cent of silicon, whilst generally silicon between these limits is required. Those buying No. 1 iron require a soft iron with low sulphur and high total carbon, and may prefer four per cent or only two per cent of silicon. Similarly in the case of the lower qualities, say No. 4 forge, some prefer above two per cent silicon whilst others require below one per cent.

As both high and low silicon irons of similar grade are a necessity in the foundry, it would be detrimental to the interests of the industry if all iron was made either high or low silicon to suit the requirements of one branch only.

Considering the matter from another point of view, some furnaces are so situated that they are best able to turn out iron high in silicon, that is, comparatively high throughout all grades, whereas others are so situated that they can with more advantage turn out low silicon irons. What is required is that those who use either one or both of these extremes, or iron of intermediate silicon contents, shall be able to obtain them with more certainty and regularity than is the case at the present time.

Abundance of High Silicon Grades.

From the point of view of those making large castings, the curse of most foundry irons is high silicon. It is a very difficult matter, in some districts, at the present time to procure iron, especially the lower grades, with a sufficiently low silicon. The tendency of most irons is towards high silicon. This is due to some extent to the leaner and more silicious ores now used, to the rapid driving and modern

*A paper presented at the Middlesbrough (August, 1906) meeting of the British Foundrymen's Association.

methods of working, and possibly to a small extent, to the persistency with which the virtues of silicon, as the universal remedy for all the troubles to which the foundry is heir, are extolled in foundry literature.

There is no doubt that high silicon iron is of very great advantage especially where sulphur is usually high, or where very thin castings have to be made, especially so if these require much machining. Generally speaking, however, a high silicon is only a poor substitute for low sulphur.

Grading by Fracture.

The question as to what the grade of pig iron depends on is rather difficult to answer, as it does not depend entirely upon the amount of any one element, but on a combination of several. Taking a broad view of the matter from No. 1 through the several grades down to white iron, it will be seen that sulphur is practically the controlling element. This controlling power is modified to a more or less extent by the relative amounts of the other constituents, but chiefly by the amount of total carbon present. The total carbon must, however, be considered in relation to the phosphorus present, and also to some extent to silicon when much above or below the normal is present.

Practically silicon varies more than any other element in the composition of foundry pig irons. Although silicon has great influence on the properties of castings, it has very little influence on the grade of pig iron as determined by fracture. Therefore we are able to obtain pig irons almost identical in fracture and therefore similar in grade which may contain from one per cent to four per cent of silicon, and even greater variation than this is possible.

The character of the irons produced in different districts, depends chiefly upon the amount of manganese and phosphorus present, but the varying amounts of these elements have practically no effect on the grade of ordinary foundry irons. Those high in phosphorus have a lighter colored fracture than low phosphorus irons.

In addition to chemical composition the grade of pig iron depends upon and is modified by the varied conditions of casting and cooling.

As the grade is determined by the size of the grains of crystals it varies to some considerable extent with the judgment of the sampler. In mottled iron, white iron and glazed iron, there is a distinct characteristic appearance apart from size of grain.

Variation in Composition.

The following tables show the extreme variations in composition of irons the author has met with. The irons are classified according to the grade for which they were bought and also those which were considered properly graded. Others may have met variations outside these extremes.

Table I.*

Silicon.	Silicon in iron bought.	Silicon in iron properly graded.
No. 1 iron....	1.05 to 5.25	1.05 to 5.25
No. 2 iron....	1.20 to 4.82	1.20 to 4.85
No. 3 iron....	.72 to 5.90	.80 to 4.40
No. 4 (foundry)	1.20 to 4.00	1.20 to 3.50
No. 4 (forge)	.50 to 3.80	.50 to 2.90
Mottled	.50 to 2.15	.50 to 2.15
White	.45 to .80	.45 to .80

*Close No. 3 included as equivalent to "Cleveland" No. 4 foundry.

Table II.

Sulphur.	Sulphur in iron bought	Sulphur in irons properly graded.
No. 1 iron....	.005 to .05	.005 to .05
No. 2 iron....	.005 to .05	.005 to .05
No. 3 iron....	.010 to .15	.010 to .07
No. 4 (foundry)	.025 to .15	.050 to .10
No. 4 (forge)	.050 to .220	.060 to .195
Mottled	.150 to .295	.170 to .280
White	.200 to .500	.200 to .500

Table III.

	Total Carbon.	Combined Carbon.
No. 1	3.15 to 4.85	Nil to .96
No. 2	3.15 to 4.06	Nil to .92
No. 3	2.45 to 4.20	Nil to 1.23
No. 3 close...	2.80 to 3.95	Nil to 1.50
No. 4 (foundry)	2.60 to 3.45	Nil to .62
No. 4 (forge)	2.98 to 3.95	Nil to 1.60
Mottled	2.85 to 3.70	1.0 to 2.5
White	2.83 to 3.60	2.83 to 3.60

Note.—No. 4 foundry "Cleveland" iron only.

The following table is taken from an article by O. Leyde in *Stahl and Eisen* mentioned in the journal of the Iron and Steel Institute proceedings Vol. 2, 1904, page 624.

Silicon average of 90 works in the United States compiled from analyses of pig iron by Seymour R. Church, U. S. A.

Table IV.

	Silicon, per cent.
No. 1 ..... From	.90 to 4.0
No. 2 ..... "	.35 to 3.8
No. 3 ..... "	.40 to 3.1
No. 4 ..... "	.20 to 2.4
No. 5 ..... "	.10 to 1.75
No. 1 soft..... "	2.10 to 5.50
No. 2 soft..... "	2.30 to 4.50

Most of the above are from makers own figures and show that irons of similar grade with high and low silicon contents are made and used in other countries besides our own. (Great Britain.)

From the foregoing examples it will be seen that silicon varies to a great extent in each grade.

Sulphur also varies but the limits are more readily defined and there is a regular increase. In actual practice we find that the sulphur is generally within certain limits, and the fracture to a great extent, indicates the sulphur.

Total carbon also varies to a great extent and in conjunction with sulphur practically governs the grain. Where total carbon is low the grain is smaller than indicated by sulphur present.

An iron with a high content of total carbon will carry more sulphur without affecting appearance of fracture than one with normal carbon. Conversely an iron with a total carbon below the normal will have a smaller grain and will therefore appear lower in grade.

Total carbon must always be considered in conjunction with phosphorus as an iron low in phosphorus can carry more carbon than a high phosphorus iron. Usually 1.5 per cent of phosphorus displaces about 0.5 per cent carbon.

Comparing the results tabulated it will be seen that no table, however drawn up, could possibly include all these variations.

These results are extremes met with in practical experience with over 40 brands of iron and are much greater than can possibly occur in any one brand. However, taking one brand considerable variations occur from time to time though some vary to a much greater extent than others.

Systems for Grading by Analysis.

Iron for the foundry, except in very few cases, is graded and sold by fracture alone. Where hematite iron is made it is often sold to analysis and the iron is graded by fracture or analysis as is convenient, but unless specified, the iron is not sold by analysis.

Practically the grade is determined by the amount of sulphur present, Table V giving the usual limits.

Table VI is that adopted by the London metal exchange for British foundry irons.

Table V.

No. 1	sulphur not over .035
No. 2	" " " .045
No. 3	" " " .060
No. 4	all above .06 sulphur which is not mottled or white.

Table VI.

	Silicon.	Sulphur.	Phosphorus.
No. 1	2.3 to 3.5	not over .035	not over 1.65
No. 2	2.5 to 3.5	" " .045	" " "
No. 3	1.75 to 3.0	" " .060	" " "
No. 4	1.50 to 2.5	" " .080	" " "

This table is based on sulphur contents. The limits of silicon given are those within which the bulk of "Cleveland iron" of these grades would be expected to fall, if made under average conditions.

Table VII is given as for British foundry iron from a paper read before this association by W. B. Parker, who it will be seen bases the grading principally on the silicon and combined carbon.

Table VII.

Grade.	Silicon required.	Total Carbon, limits allowed.	Combined Carbon maximum.	Sulphur, maximum
No. 1	3.8	4.0 3.25	.10	.05
No. 2	3.25	3.5 3.00	.20	.05
No. 3	3.00	3.25 2.75	.30	.05
No. 4	2.75	3.00 2.50	.40	.06

Table VIII is that adopted by the American Foundrymen's Association.

Table VIII.

Grade.	Silicon.	Sulphur.
No. 1	2.75	.035
No. 2	2.25	.045
No. 3	1.75	.055
No. 4	1.25	.065

Variation allowed:

Silicon 10 per cent of above values either way.

Sulphur .010 above standard.

The foregoing tables may be convenient for defining standard qualities but a great quantity of iron now used in the foundry is outside the limits given.

Grading by Analysis.

The system of grading by analysis most suited to both the foundry and the blast furnace is one in which the grade is based upon a fixed scale of sulphur contents.

Note.—No. 1 iron not under 3.3 per cent total carbon. Cleveland irons. No. 1 iron not under 3.8 per cent total carbon. Hematite irons, both medium silicon or No. 1. Fracture accepted as equivalent to above carbon contents. Variation of sulphur allowed 0.005 per cent above standard for No. 1, 2 and 3, 0.01 per cent above for No. 4 and lower qualities.

No. 1 iron in addition to sulphur requires specification of total carbon or fracture.

The following table shows proposed sulphur limits, the grade numbers being those in general use in this district.

Table IX.

Grade.	Sulphur.	Silicon.	Total Carbon.
No. 1	not over .04		See note.
No. 2	" " .04		Not specified.
No. 3	" " .06	To specification with	" "
No. 4 (foundry)	" " .08	25 per cent allowance	" "
No. 4 (gray forge)	" " .12	above or below	" "
No. 4 (hard forge)	" " .18	amount specified	" "
Mottled	" " .28		" "
White	all over .28		" "

The sulphur limits given would include the bulk of the iron graded to these numbers by fracture.

Using this system of grading founders would order iron of any definite grade (or equivalent sulphur) with one per cent or three per cent silicon, or any other percentage of silicon required.

When iron of definite silicon contents is ordered, should iron of that particular percentage not be available, the equivalent amount of same grade irons which would give the required percentage when mixed, would be taken if advised and shipped separately but in no case would iron of above 0.50 per cent variation either way be taken except by special arrangement.

In addition to grade (i. e. sulphur), in place of ordering iron to any definite percentage of silicon, the following or some similar classification can be used.

For the purpose of defining standard qualities and for convenience of stocking this system will probably be more acceptable to the blast furnace people.

Glazed iron (silicious iron) would be classified as special high silicon iron, and would usually fall within sulphur limits of No. 2 and No. 3 qualities.

Using this classification founders would order iron of any grade (or sulphur) of high, medium or low silicon or special high or special low silicon when these extremes are required.

There are furnaces, the bulk of whose make of pig iron would be medium silicon, if classified according to Table X. There are others making iron almost entirely below the medium in silicon contents, while other furnaces turn out iron which seldom falls below the high silicon classification.

In all cases where iron is sold to analysis, or grade and silicon classification, as outlined above, the actual analysis of sulphur and silicon in the iron sent must be given to the buyer.

Considering the requirements of analyzing, selecting, and stocking to analysis, it is questionable whether

the bulk of pig iron makers are in a position to sell to analysis.

There are furnaces, even in these days, which do not keep a chemist, and there are many which do so, that confine their attention almost entirely to the materials they buy, and pay very little to the iron they produce.

There are also some which do partial analysis as a daily routine, but which if asked for a complete analysis would have difficulty in finding one of recent date in their books. There is no doubt a small majority which could without much additional expense sell the bulk of their iron to analysis.

However, even if the pig iron producers were able to sell to analysis very few founders have sufficient knowledge of their requirements, as regards analysis to be able to take advantage of that system.

Selling by Grade and Silicon.

As an alternative to selling entirely to analysis, the author proposes a system intermediate between that at present in use and that just outlined, namely, buying by grade and silicon. This is an advance on the present system and is practically the first step towards buying by analysis.

This method incurs very little expense for analysis at the furnace and can be worked in conjunction with selling by fracture or selling by analysis.

Providing the silicon is known, the fracture of pig iron is generally a satisfactory guide to its behavior in the foundry. That is to say, the fracture usually indicates the amount of sulphur or the ratio of sulphur to total carbon.

With this system the grade and silicon classification according to table would be used. As the grade would be determined by fracture, sulphur would not be guaranteed, but would usually be found within the limits given.

Founders using this method of buying would order any definite grade with medium, high, or low silicon or special high, or low silicon as required.

Table X.

Grade.	Sulphur.	Special low.	Low.	Silicon. standard quality.	High.	Special high.
No. 1	not over .04	below 1.8	1.8 to	2.5 to 3.3	to 4.0	above 4.0
No. 2	" " .04	" 1.8	1.8 to	2.5 to 3.3	to 4.0	above 4.0
No. 3	" " .06	" 1.5	1.5 to	2.2 to 3.0	to 3.8	above 3.8
No. 4 (foundry)	" " .08	" 1.3	1.3 to	1.8 to 2.6	to 3.3	above 3.3
No. 4 gray forge	" " .12	" 1.0	1.0 to	1.5 to 2.0	to 2.8	above 2.8
No. 4 hard forge	" " .18	" ..	.80 to	1.3 to 1.8	to 2.5	above 2.5
Mottled	" " .28	" ..	below	1.0 to 1.5	above 1.5	
White	all over .28	" ..	below	.5 to 1.0	1.0	

With hematite irons No. 4 grade includes the three No. 4 grades given in table. It would be more convenient for founders using these irons if the grading of this table was adopted and possibly more profitable to the makers as a graduated decrease in prices could be substituted in place of the present difference in price between No. 3 and No. 4 qualities.

Under the present system of grading by fracture, a founder ordering No. 3 iron may require three per cent of silicon. Should the iron on the pig beds contain one per cent or any other amount, if the fracture is No. 3 it is shipped independent altogether of what his requirements are, and in all probability the founder who requires No. 3 iron of one per cent silicon, will get No. 3 iron with three per cent when it is made. Buying to the foregoing classification of silicon would enable the founder to buy iron of more uniform silicon contents.

Furnace Analysis.

Actual analysis of silicon contents must be given by the pig iron makers,

of all iron sent out. Where possible sulphur contents might also be given, but no guarantee of sulphur limits would be given, fracture and silicon limits only being guaranteed.

A system of this kind would soon educate both the founder and the iron maker to the requirements of buying and selling to analysis.

As either of the foregoing systems would only come gradually into general use, the iron producer would be able to select iron of definite analysis for those requiring it, and sell the remainder as at present to those requiring fracture only.

The proposed silicon classification would not be entirely suitable to those making only low silicon irons such as cold as blast irons. In this case makers themselves could draw up a table of classification based on a lower silicon content.

Before selling by analysis can make any progress, the makers of pig iron will have to give more information regarding the general composition of the irons they make, and the usual limits of silicon in the different grades. They will also have to state the limits of variation they are willing to guarantee, and whether they are willing to adopt or sell by any of the various schemes put forward for grading or selling by analysis. This is a matter which in the near future they will be compelled to seriously consider.

DIRECT METAL CASTINGS.

By Thos. Wathey.

The writer worked for five years in front of a blast furnace, beginning when he was between 15 and 16 years of age, and previous to that time worked about two years in the foundry of his father, which gave him some insight into general foundry practice. The furnace at which he was first located melted from 50 to 100 tons per day of 24 hours, and was tapped out four times during the 24 hours, that is, at 11:00 a. m., 5:00 p. m., 11:00 p. m., and 5:00 a. m. Sometimes, however, there was an extra cast and then the time was divided accordingly. It was not an unusual thing for the furnace to give nice gray iron at night and in the morning iron that was so white that they could do nothing with it. By observing the cinder when first going on to the floor you could tell what kind of iron was in the furnace. If the cinder was black the iron was white. If the cinder was gray the iron was soft. The color of the cinder determined whether we would work that day or not, and the days off came very frequently. About the first job that I was put on was making pig molds. They weighed about 2,500 pounds and were made below the pig bed proper so as to get a fall in the runner for the iron. The pattern was placed on a board and a flask of the proper size placed on this. The flask was always an iron box with flat bars running across so as to hold the sand from falling out when it was turned over, as no bottom boards were used, the flask being turned over on to a bed.

A branch was then made from the main runner and after some iron had flowed by the runner it was turned in until the mold was nearly full. It was then stopped with the dam plate, which will be described later. I worked at this place about six months and then went to work for the Dowlais Iron Works Co., which was at that time the largest iron works in the world, there being 18 blast furnaces in use. The writer worked at No. 18. At this furnace there were 25 men preparing molds and getting the iron from the furnace. The molds included green sand, both open and closed, dry sand and loam. The writer worked on green sand most of the time and every casting that was made was watched clear through the machine shop to see how it turned out. The castings were just as good as those made in any other foundry, with the exception of the fact that sulphur would bother us sometimes. Near me was a floor for small dry sand and loam work. They used to cast the greater part of their heat in the morn-

ing. If they did not make a runner down to the floor they would make a hole in the runner that took the iron to the pig molds and ladle out what they wanted into bull ladles and carry it to the floor.

There was a cupola and an air furnace in the shop, the air furnace being used for casting rolls and spindles and the cupola for reserve capacity when special iron was wanted or when the furnace was idle. Some people seem to have the idea that if the castings were made at the blast furnace they must of necessity be open sand castings, but it is not so if the molds are low enough so that they can be cast from runners, for castings can be turned out that are just as clean as those made by any other method. After making a runner to the casting, what we call a dam plate was put in. This is a cast iron plate the shape of a runner, but a little larger. It is made ready by dipping into a thick solution of sand and clay wash and then drying. Two rods are driven into the sand, one on each side of the runner and the dam plate placed in front of them. At the back of it there is a little wall of sand built higher than the bottom of the plate so that when the iron comes down it will be skimmed and no slag will get under the dam plate. If only one or more castings are required on this runner, experience will tell when there is enough iron in the runner so that by stopping it off the iron will all be used up in the molds.

We used to cast car wheels or wheels of about that size and two floors of smaller wheels. These floors ran along the walls so that when the molder lifted the cope it simply turned back against the wall. The pattern was then drawn and the cope laid down once more. The gate sticks were left in all of the molds until the runner had been built up across the top of the molds. This runner was supported by some 4-inch angle iron, there being about 18 flasks in the line. There was a small dam at the back of each runner and a small pig at the bottom of the floor to receive the overflow metal, but a man who is used to it can tell very closely when he has enough iron in the runner so that he will not have much free iron.

We made castings there that weighed as much as 54 tons and others as small as 1 pound each and never heard any complaints from the machine shop. The furnace was a hot blast furnace, but instead of having four blowing engines to one furnace they had four furnaces to one blowing engine.. The extreme pressure put on the furnaces these days may have a tendency to make an iron of such a nature that it cannot be used directly in casting, but there are certainly lots of castings made in the country that could be made direct from the blast furnace, as for instance, the counter balance weights for bridges and other similar pieces. Floor plates, furnace plates and tunnel segments could be made this way also. The writer would also think that water pipe could be made to advantage from direct metal.

Some will say that the contraction from the furnace metal is so much that the sockets would pull off, but the writer has seen them pull off when cast with cupola metal. If some one would take this matter up and work out the details it seems as though he ought to be able to make a good thing of it.

MELTING BRASS WITHOUT CRUCIBLES.

By J. D. Fry.

One of the great problems confronting the brass founder in these days of close competition is how to economize and bring forth dividends instead of deficits to his employer.

The advance in the cost of raw materials of all kinds makes it more difficult, as the old stock he may have on hand is dwindling, and he is forced to buy at an advance materials he

needs. He cannot save in reducing wages, so he has to devise ways to economize in the handling of his materials.

Whether he shall continue in the way his fathers did and use ancient methods or adopt new methods, depends the success of the business and therefore the continuance of his position.

One of the great (if not the greatest) economizers in the brass world today is the oil or gas furnace, which not only dispenses with the enormous cost of crucibles, but saves in labor and fuel cost and leaves no ashes to be washed. The brass foundry of today that is without this furnace is not modern nor progressive.

Of course, the crucible manufacturer claims the oil furnace is no good, that the metal is porous, etc. But that is part of their business, as it is only human nature when a man sees a good thing passing away that he should grow indignant.

However, when we consider a saving of from fifty per cent to sixty per cent in melting and handling metals, it seems as if the practical mind would not hesitate to use the oil furnace in preference to paying $5.50 to $6.00 per ton for the sake of methods used by the ancients, and to put dividends into the pocket of the crucible manufacturer. The great difficulty lies in finding men in charge of foundries who are progressive. The common complaint of the foundryman is that a new idea is not practical or this or that is lacking.

No man can be successful nor make his business pay if he does not have the energy and courage to thoroughly exploit new ideas and new methods. The foreman who wants to sit in an office all day long with a pencil behind his ear and look wise is "N. G." He must "dig in" or he will get thrown out.

I had occasion during the last year to visit several foundries where the Schwartz furnace was used and found, as a general rule, they were very satisfactory. Several large firms are using them very successfully and at an immense saving. Notably, the Kelly & Jones plant at Greensburg, Pa., plumbers' supplies, with six. The Westinghouse Air Brake Co., at Wilmerding, Pa., with nine, and the Westinghouse Electric & Mfg. Co. with seven, and several others.

I was in one place where the blower was placed about fifty (50) feet from the furnace and where they used a slide to shut off the air, and the foreman could not understand why he did not get as good results as some other foundries. His furnaceman said he got an 800-pound heat every hour and could get it in forty-five minutes, but he did not want to queer the job.

One place they had taken out over 4,000 heats without a re-lining.

I saw a heat of 500 pounds, gates and scrap yellow brass, taken from a No. 2 Schwartz in twenty-three minutes with a loss of one per cent and poured into castings made on the bench.

I saw a 1,200-pound heat of phosphor bronze made in a No. 2 Schwartz (the phosphorus being introduced into the metal while in the furnace by means of a phosphorizer) and poured into car bearings which finished as perfect as any bronze made in a crucible.

I might go on indefinitely and cite examples and tests, but space forbids, But this type of furnace has come to stay and the foreman who objects to modern progress is going.

The man who with a helper stands over six coal or coke fires and gets out 1,500 pounds of metal every three hours will be succeeded by the bright man, who with a helper, will run four Schwartz furnaces and get out 4,000 pounds in one hour.

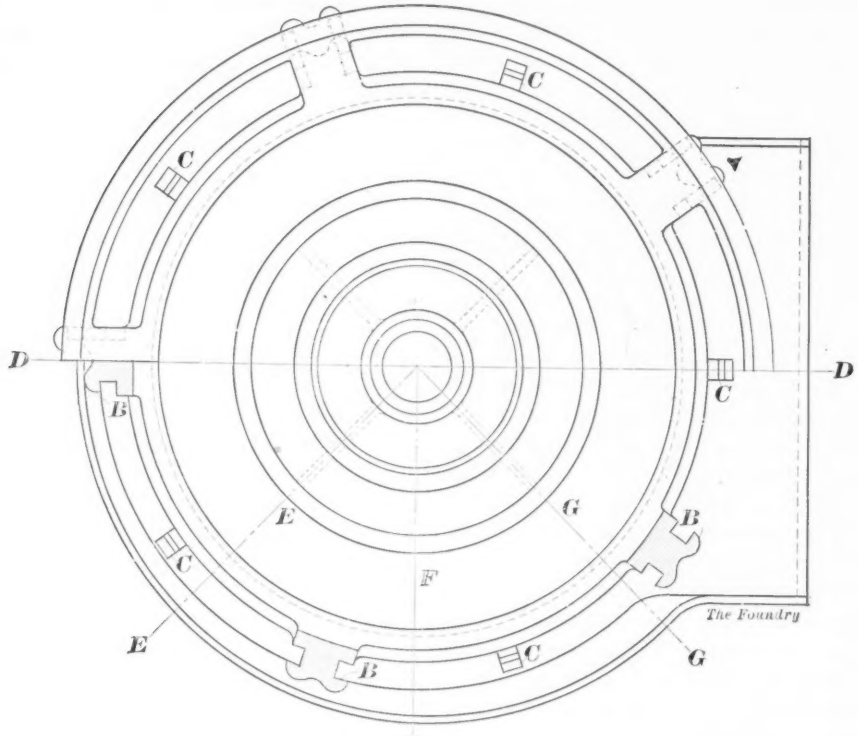
The man who helps pay the dividends is a winner,—likewise the furnace.

THE PATTERN SHOP

PATTERN FOR A CHILIAN MILL MORTAR.

By H. J. McCaslin.

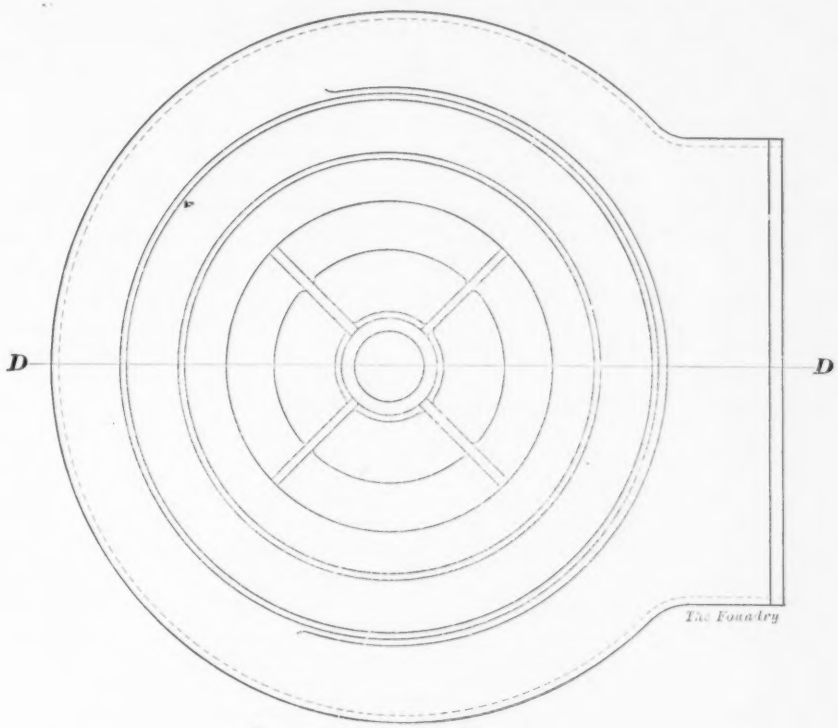
Several views and sections of the casting to be made are shown in Figs. 1, 2, 3, 4 and 5. In Fig. 1 there is given a half plan and sectional plan on the line AAA, Fig. 4, which shows the upright members of the casting located between the screen openings, together with the wedge chucks B and C. These wedge chucks are used for wedging or securing the screens in place. Fig. 2 shows the bottom or inverted plan of the mortar, while Fig. 3 gives a side elevation, and Fig. 4 a longitudinal section of the mortar taken on the center line DD, Figs. 1 and 2. This section, with the radial sections shown in Fig. 5, which are taken on the lines EE, FF and GG, Fig. 1, should receive careful attention in order that the construction and molding of the pattern may be more readily understood. It is from these four sections that the pitch of the trough is obtained and the laying out of which will be described during the construction of the pattern.



Section at A-A-A
Fig. 1

Laying Out.

Of course a full size working lay-out is essential for reasons well-known. The sectional lay-out should be taken through the center of the mortar as shown in Fig. 4, and this view will also serve for laying out the trough, etc. A lay-out of the plan is also required, but as the mortar is symmetrical about the center line DD, Fig. 1, a half plan lay-out is all that is required.



Inverted Plan of Mortar
Fig. 2

Construction of the Pattern.

While a mortar pattern of the design shown is not of a particularly intricate nature it nevertheless contains some very good features in patternmaking and also in molding. The writer has made a number of mortar patterns of this general type in the manner described and this method of constructing the pattern as shown has been found to give a durable pattern and at the same time is as economical in time and material as could be desired. Fig. 6 shows a longitudinal section of the assembled pattern taken on the center line DD, Fig. 1. This section should give a fairly good idea as to how and where the various parts of the pattern are joined and fitted together. While all of the partings shown are not essential or required in molding they nevertheless facilitate the drawing and also tend to prolong the life of the pattern, on account of the fact that the different parts can be removed from the sand separately and with less rapping as the dressing of the mold proceeds. Another advantage in constructing the pattern in sections is that it is easier to handle and store. This sectional construction also affords protection to the hopper section, which

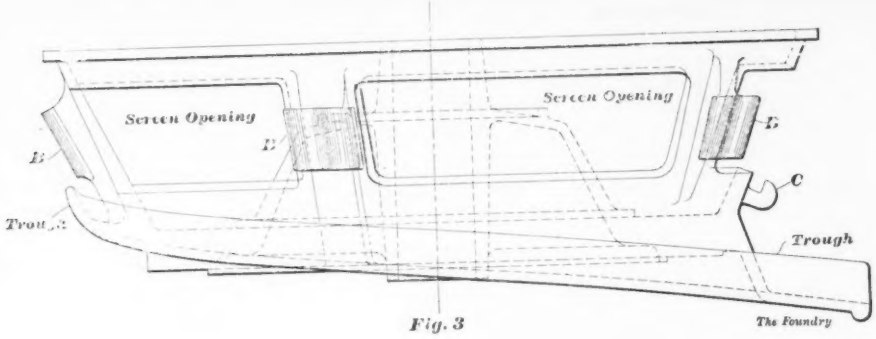


Fig. 3

is of rather light and frail construction.

Shown at the left of Fig. 6 can be seen one of the wedge chucks B. By studying a section of one of these chucks as shown in Fig. 1 it will be seen that it would be necessary to core out the slots and if this were done with a dry sand core it would

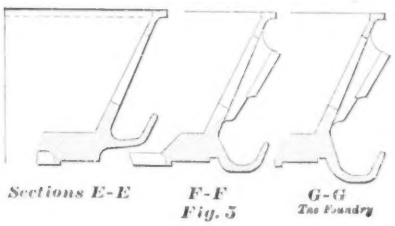
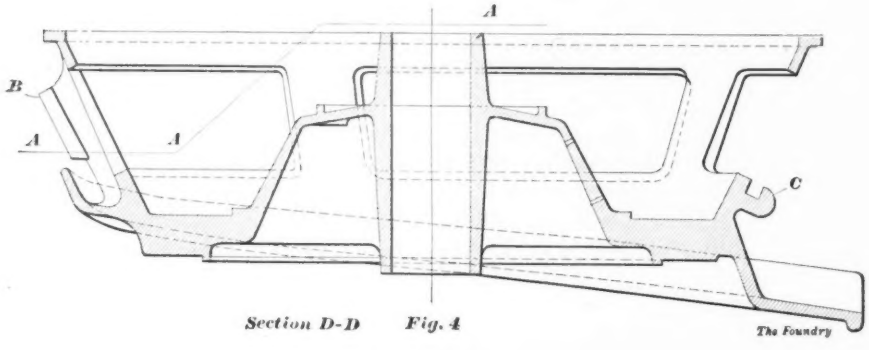


Fig. 5

necessitate a troublesome core setting, as it would come on the parting line of the drag and cheek portions of the mold. To avoid this objectionable feature this part of the pattern was arranged as shown by a section of the chuck at the upper left hand corner of Fig. 6. This has overcome the difficulty very satisfactorily, as the arrangement allows the two ears to be drawn in and the dry sand core set in place to form the outline of the back of the chuck as indicated by the dotted lines. Wedge chuck C is shown to the right in the figure and the manner of coring out the slot is self-explanatory.

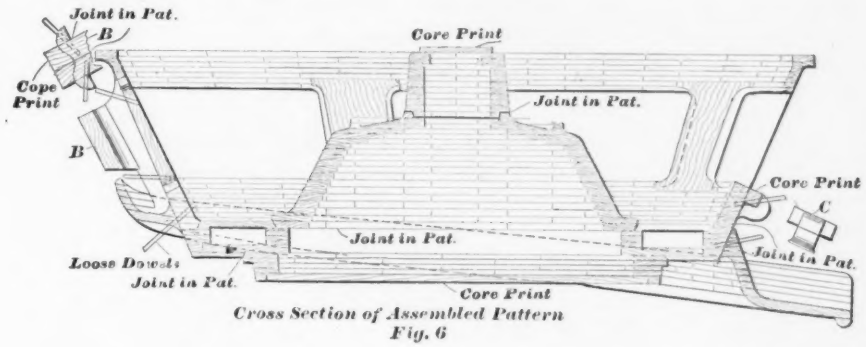
Shown in Fig. 7 are the four separate sections or parts that form the body or center of the pattern, arranged in the order in which they are placed together. In beginning the building and turning up of the parts the center portion H receives attention first. This part can be built up on the face plate of the lathe somewhat after the manner and in the position shown. This is followed by the turning of the face, with its two offsets I and J. Offset I receives and locates the lower rail K of the hopper, while offset J locates the center or conical portion L of the pattern. The most convenient manner of disposing of the two parts K and L is to build them up and turn them in position upon part H, as shown by the dotted lines in Fig. 7. It will be seen that all that is necessary is to fit the first course of



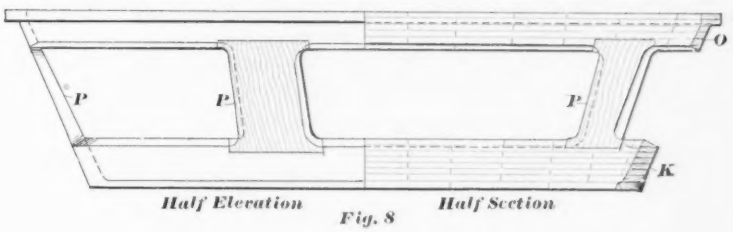
Section D-D *Fig. 4*

segments in their respective offsets, pin and screw them in place, taking care to leave the heads of the screws exposed so that they may be removed and then proceed with the building up and turn in in the usual manner. At the completion of the two members they are removed and part H rechucked so that it can be turned on the outer diameter and back. During this turning the offset M is formed to receive the core print N, as shown. The hub Q is of course turned independently and fitted in place during the turning of the portion L.

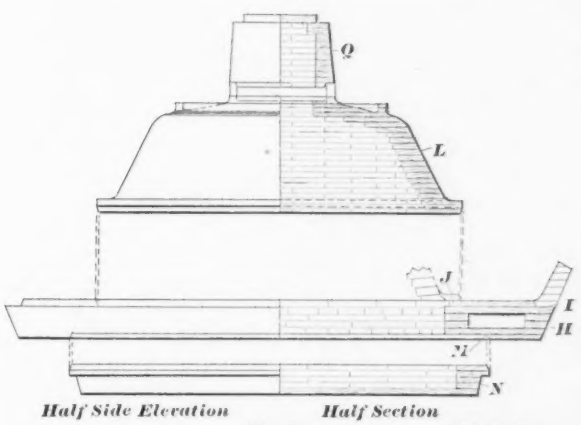
Our attention is next given to the upper rail O of the hopper which is shown in Fig. 8. This is built up and turned as shown. The center lines and widths of the five standards P are next laid off on both rails K and O, the rails are then cut out to receive the standards and the latter portions secured in place as shown. After fitting on of the edge chucks B and C as shown in Fig. 6, the building up of the trough which is shown



Cross Section of Assembled Pattern
Fig. 6



Half Elevation Half Section
Fig. 8



Half Side Elevation Half Section
Fig. 7 The Foundry

in plan and section in Fig. 9 next takes our attention. This figure shows a half plan and longitudinal section through the center on the line DD, also radial sections on the lines

designing of mortars of this type, that is, it does not have a uniform pitch or drop from back to front, which would, of course, bring the bottom of the trough always in the same plane.

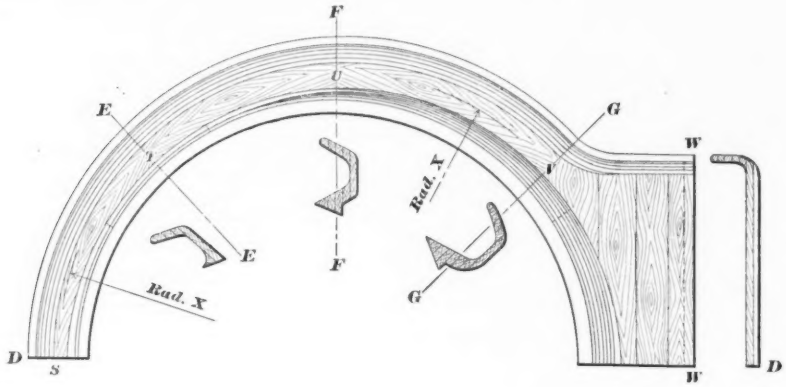


Fig. 9

Section D-D

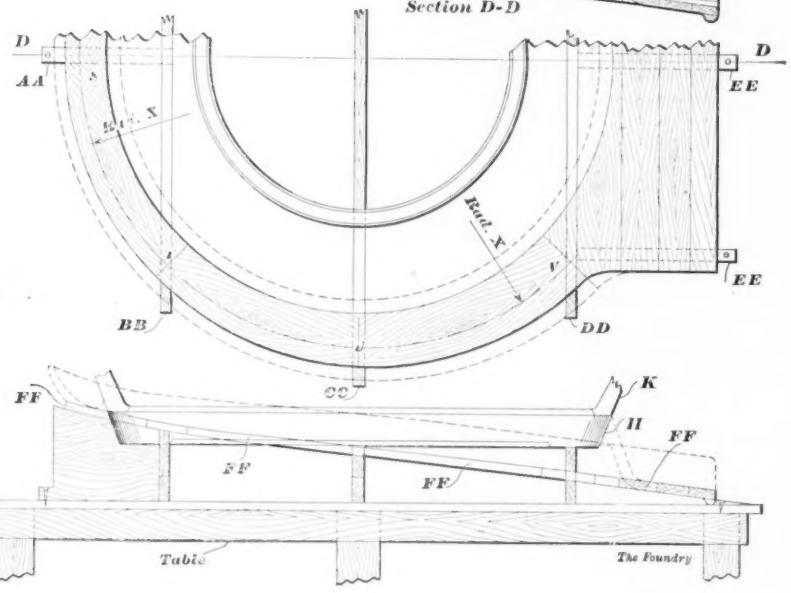


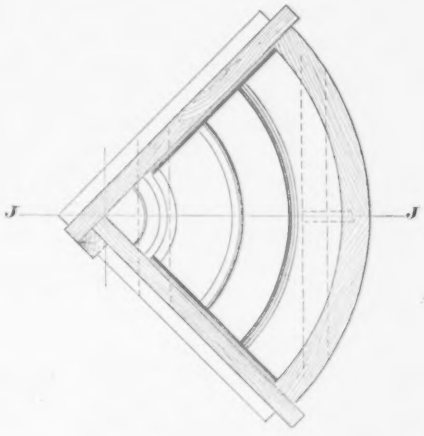
Fig. 10

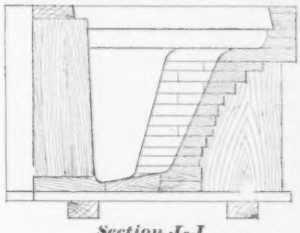
EE, FF and GG. These latter sections serve to illustrate the general construction of the pattern. By studying the figure it will be observed that the pitch of the trough is not regular, as is the usual practice in the

In the case under discussion the pitch of the trough varies, the amount of pitch or drop being given at four stations, S, T, U and V, at the center of the trough, as shown by the radius

X, the pitch being decreased toward the apron.

Fig. 10 shows one way in which the trough may be laid off and built in position up to the body portion of the pattern. This manner of constructing the trough will be found about as convenient as any other method. The five stringers, AA, BB, CC, etc., representing the five stations of the drop or pitch of the trough, are first gotten out and dressed to the required height of the underside of the trough as shown. They are next secured to the work table in their respective positions and their proper relationship one to another and also to the body of the pattern, which is placed in position and secured temporarily as shown. The segments or material FF, which is to form the bottom of the trough is next gotten out roughly to size and of ample thickness and width to allow for sawing and dressing to form. In length the material FF is gotten out equal to the distance between stations, at which points it is butted together as in segment work and temporarily bradded down. Next, with the trammels so arranged that one point will extend down over the center portion, H into the center of the trough, the center line of the trough or the radius X is scribed. The different widths at the bottom of the trough are now taken from their respective layouts as shown in Fig. 9 and transferred to the material as shown at AA, BB, CC, etc. This is followed by the sawing of the segments to size. The next work consists in the dressing off of the under side of the segments from station to station so that the segments will conform to the pitch. This is done carefully by the eye and the exercise of a little judgment, is all that is necessary, as there is nothing of great importance attached to the trough and a slight variation one way or the other will not make any material difference. Having the underside of the material or segments worked to form, it is next necessary to reduce them to the required thickness, which is a very simple operation. After this the segments are returned and bradded in place. Fig. 10 shows the work at this stage of completion, ready to secure the segments, the positions of which are indicated by the dotted lines. The first course of segments at the inner and outer diameters of the trough must be applied to the



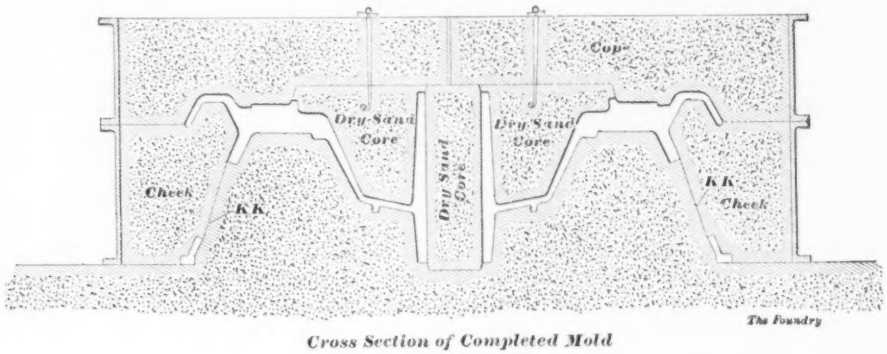


Section J-J
Fig. 11
The Foundry

irregular surface, hence it will be necessary to chalk and fit them for a glued joint. After these two courses are fitted and glued in position their upper faces can be joined straight, which will allow the remaining course to be joined in the usual manner. If each course of segments is carefully marked from the previous course, applied and sawed to line and beveled, very little work will be required in dressing them to form.

As the first course applied forms the fillet, it will be necessary to work this out with a gouge. It will be noticed that the first two courses of segments which form the inner wall

of the trough are fitted up to part H of the pattern or about half of the distance around the pattern from which point they will extend or flair outward on to the apron, as shown in Fig. 9. Before removing the work previous to dressing up the under surfaces holes should be bored for loose dowel pins to attach the trough to the body of the pattern to facilitate the process of molding. Next, the usual provisions for rapping and drawing the various parts of the pattern must be made, the pattern finished with shellac, etc., when our attention will be given to the construction of the core box. The core box necessary is shown in Fig. 11. The core made in this box forms the interior of the conical center of the casting, as shown in the cross section of the completed mold, Fig. 12. The illustration of the box shows its construction fully so that no detailed description is necessary.



Cross Section of Completed Mold

Fig. 12

Molding.

The manner of making the mold is clearly illustrated in Fig. 12. As this section is taken at the center line of the mold the parting appears about on a line with the joint of the flask. This fact would not be the case at the right or left of the section shown, owing to the pitch of the trough to the right and left of the line, upon which the section was taken. The parting would, of course, extend up into the cope on one side and down into the cheek on the other. By inverting Fig. 6 the line of the parting can be easily followed. In drawing the pattern from the sand the cope is lifted off first, the trough portion of the pattern drawn out, and this permits the lifting off of the cheek. The line of parting between the cheek and the interior body of sand which forms the interior of the hopper is shown along the lines KK. After the cheek has been removed the other sections of the pattern can be withdrawn in their respective order and the mold finished in the usual manner.

METAL PATTERNS.

By John Magee.

It is proposed in the following article to discuss the subject of metal patterns for light specialty work, and we therefore need consider only steps subsequent to the construction of the wood pattern. Our first attention must be given to the equipment of the modern metal pattern shop, and in so doing it is always, to be understood that each factory is a problem distinct from every other, and that a paper of this kind cannot be made to cover all cases, but only to serve as a guide which must be abridged and adjusted to fit any particular case.

First and foremost in the equipment of a metal shop is the selection of a proper foreman who is a machinist and a practical molder in addition to having a thorough knowledge of both wood and iron patterns. If it is impossible to secure the services of such

a man (as will probably be the case) cover as many of the qualifications as possible and have him learn the other trades in your shop and at your expense, and then pay him a salary that will prevent your losing him. It must be remembered that such a man's time can all be profitably spent in supervision, and that actual work can better be done by cheaper employes.

It is unfortunate that there has always been a state of war between the pattern shops and the foundry, but it seems to be one of the traditions of the foundry business that such should be the case and a foreman should be selected who will discourage this spirit and avoid a common source of trouble.

Care should be taken to inculcate proper spirit among the employes of the metal pattern shop. Here quality counts as in few other departments of the factory and should be the only standard by which a man is judged. Insist that each man shall be constantly busy and beyond that judge him only by the quality, and not by the quantity, of his work. Men are rare who can do large quantities of this class of work and do it well; they are capable of earning and saving money for their employers and are able to demand, and should receive good pay.

The shop itself should be located where there is an abundance of light, and should be equipped with light and heavy drills, portable pneumatic drills, emery wheels in profusion, forge and crucibles, plumber's furnace heated by gas, grindstone for sharpening tools, a small wire brush driven by power for brushing out files, and a most liberal supply of small tools. The whole efficiency of the metal shop is in a large measure dependent on this question of small tools. They should be stored in a rack having a compartment for every possible file, riffler, and scraper that is ever required, and this rack should be under the charge of some one employe. Each workman should be provided with a certain number of checks to be exchanged for tools, these checks to remain in the rack until the property is returned. This will prevent loss, as each man must have his whole number of checks, or a tool for each one missing, and the tool boy must have the whole number of tools owned by the department or a check for each one out.

Workmen should not sharpen their own scrapers or brush out their own files, for their time is of greater value for actual work, and when a tool requires attention a new one should be used, and all sharpening, etc., left to the boy in charge of the rack. Each night everything should be returned; the boy should lay aside those to be tuned up; and they should not be issued again until they have been put in first class repair. This system will assure that the usual litter of small tools (with their cutting edge blunted from stirring them up in search of a missing one) usually found on the iron filer's bench will be avoided, loss of tools will be less, and each one in use will be capable of doing the full amount of work for which it was intended. In purchasing new equipment, buy only the best quality as the economy of such a course is unquestionable.

In some shops a profiling machine, planer, sharpener, and lathe are provided and where they are a part of the equipment are constantly and profitably employed; and a small brass furnace has many uses other than the casting of patterns and will be used by other departments as well. A blow pipe torch should be furnished for heating patterns locally, to straighten them, and a vault for the nightly reception of work in progress is requisite where valuable patterns are handled. Vises should be plentiful, adjustable in every direction, and of rapid action. In some places a magnetic vice or face plate will hold work that would otherwise have to be drilled to get a grip; but in working patterns so held the magnetic attraction of the chips for each other and for the work may cause trouble. Some patterns with broken or ornamental surface can be

finished with a burr or milling cutter run by the compressed air drill.

Supply all windows with adjustable shades, and put portable electric lights on all benches, in addition to a plentiful supply for the general lighting of the shop. A good pair of scales should be found in the shop equipment, also cabinets for brass wire, sheet metal, and other supplies; and workmen will find a small air hose on each bench a convenience for brushing away chips.

An emery wheel for attachment to the compressed air drill, so that it may be taken to the work, will do good service in removing scale; and pickle tanks for final surface preparation should be located in the shop, but well protected by ventilating hood, so that the fumes can not escape into the room.

In one corner should be a small molding floor, fully equipped with a variety of sands; and all work in soft metal, and all trials of new work for proper drafting, should be done there. Where iron patterns are used, one or more molders skilled in this class of work should be detailed to the metal shop and should be under the control of the foreman of the department for the molding of pattern work. The patterns used must be considered the most important tool that is in the factory; in fact nearly the only one that is indispensible, and as such it should be the best that money can procure and the department that has charge of its being should not spare any expense that will better the product.

With an equipment such as outlined and with intelligent conduct, the cost of pattern work should be low, and the superior quality of the work produced, more than enough to justify the expense of the "fancy" equipment.

A metal pattern starts its life with the pattern molder, and he should be a man well acquainted with pattern shop troubles and able to co-operate and aid, by tool work done on the sand mold. Many fillets can be so cut cheaply, and shop letters and numbers can be better printed on the sand mold with steel stamps than by any other way, and if carefully done with superior results, but tool work on the surface of the mold should be avoided if it is to be used for a pattern, and facing should be used only sparingly.

The treatment that the pattern receives in the foundry is to establish the whole future cost of the many castings made from it, and molder and foreman jointly should give careful attention to the best form that should be used, whether shell, match plate, gate or machine; they should also determine the economical number of pieces to put in a flask, and whether to cast with iron, brass, aluminum or soft metal. After decision of these points, mold for the pattern should be prepared with great care and should be remolded as many times as is required to get absolutely perfect results. Foolish economy on patterns does not pay, and a cent saved here may mean something lost on each of a thousand castings made later. No press of time or other reason should compel undue haste. In shaking out pattern: care should be observed to allow proper cooling so that a minimum of strain will be created.

Iron has been generally accepted as the proper metal for patterns which have to stand hard service, but brass is often better and in some cases aluminum can be used. Where patterns are made of iron the metal should be as soft and tough as can be obtained and if the regular mixture is not suitable, a small cupola can be used for this purpose, and will work in well for other things, such as taking off a small melt for some rush casting when shut down, experimental purposes, etc. Where the iron is taken from the main cupola it should be taken from that part of the melt when the quality of the iron is supposed to be best. In actual practice, there seems to be a great variety of opinion as to whether this point is in the first or last of the heat, and it is probable that it depends somewhat on the nature of the cupola used. It is a simple matter of experi-

ment, however, to form conclusions on the subject.

It must be remembered that although the first cost of brass is higher the metal is invested, and that when the pattern becomes obsolete the value will return with but little loss, and the ease with which the pattern may be finished will more than make up for the interest on such investment. A hard brass will be found, if properly mixed and poured, to make a pattern free from pin holes and one that will work well in the sand. It is not easily broken, and if such an accident should happen, can be readily repaired. Brass is of course subject to dents and bends and for that reason is of limited use. Aluminum is not in general use but should be, for patterns of large size. In making patterns, an alloy of about one-tenth zinc to nine-tenths aluminum should be used, which will be found light, strong and capable of taking solder. The finishing of this metal requires experience and can be done only with a wet riffler or file.

For all temporary work, soft metal is best, and in the use of any metal, the variation in shrinkage should be considered when making the wood patterns. Brass, aluminum, and soft metal patterns can best be molded and cast in the pattern shop, using the forge, crucibles, and molding floor previously mentioned. In some cases of flat, thin, plain work steel plates can be inserted instead of trying to finish a surface to even thickness in cast iron. It is difficult however, to attach such plates to the main body of a pattern so that the usual treatment received in a foundry will not cause them to work loose.

The nature of the pattern to be made is of course determined by the size of the piece, the probable number to be made, and other local conditions. With small patterns, match plates or gates will probably be found to pay for the extra expense involved, unless the number of castings is very small; and where the number is very large molding machines should be used. In placing specialty work on the machine, cases will be found where the daily output may be as high as 10,000 pieces, and if only a few pieces are used each day, the investment that must be carried on the racks and the possibility of loss through change in design of the piece may balance all possible saving. It rarely pays to put pieces on a machine that cannot be run for at least one day at a time.

With large shell patterns the practice of mold boarding one, two or three pieces together is customary but in no case should patterns of two different pieces be placed on the same board as the loss of one is sure to be greater than the other with consequent unevenness of the storage racks. Where numbers of large shell pieces are made, table patterns should be used, one for the cope and one for the drag, and worked in the foundry by a man on each.

After leaving the mold, the surface of the pattern should be freed from scale and then pickled, remembering however that this outer skin of a casting is subject to local strains and that its complete removal will free these strains and cause distortion, so that care should be exercised to take away only as little as is necessary to get a workable surface. In some cases notably on heavy work—all finishing can best be done with the machine tools but as the entire surface is here removed it is best to make several cuts at intervals of a day or two in order that the strains, and consequent change of shape, shall have time to adjust themselves between cuts. In general this class of work requires expert handling, but results are obtained not possible in any other way. Thickness should be allowed on the wood pattern for the finishing cut removed by the machines. Proper finish of all classes of metal patterns is largely a question of proper tools replaced or sharpened as soon as the slightest dullness shows.

When pin holes exist, solder or soft brass rivets are used; the interior of the cavity roughened for solder, and

holes countersunk on both sides for rivets. It is generally cheaper however, when all is considered, to make a new pattern in the foundry rather than to patch up defective one, in the hope of making it good.

It is the place of the pattern foreman to be sure that each pattern will draw properly, before it leaves his hands, and it should be molded in the pattern shop both before and after mold boarding to see that all drafts work right.

Final finish may be given a pattern in many different ways but will not be satisfactory to a lover of good work unless the surface has been properly tooled. Probably the best all round finish for iron is rust rubbed in with flour emery, treated with beeswax applied hot, and with wood smoke. This works well in the sand, but is unfortunately subject to rust. Another finish is obtained by the use of bayberry wax applied hot or in gasoline solution and some of the stock preparations put out by the supply houses will also give good results.

The proper fitting of patterns deserves particular emphasis. All joints should come to place solid, time should be given each until it is exactly right, and all bolt holes should be located with great care. Even with the most careful fitting, troubles will occur later, and it pays to avoid them as far as possible.

For fitting a piece of work composed of a large number of pieces, as found in stove shops, an iron face plate table should be made with its surface accurately divided into half-inch squares. At one corner an absolutely vertical post is erected with a horizontal bar, adjustable as to height, projecting over the table and revolving around the post. In setting up new work, each course erected should be leveled by means of the bar, and all vertical lines checked by means of a plumb bob from the cross arm, the squares on the plate serving to determine the proper distance of the vertical lines from some selected base line.

It is hoped, by the writer, that in the outline given above may be found some points of interest to the readers of the FOUNDRY. Space is necessarily limited and much has been omitted in favor of more vital and novel points. In this connection there is subject matter for long articles on Storage of Patterns, Handling Patterns, Designing and laying Out Metal Patterns, Cost Keeping in the Metal Shop, Flasks and Mold Boards, etc., but all discussion of these topics will have to be omitted from the present article.

TWO CONSTANT OBJECTIVES.

BY THOS. F. KENNEDY.

In making molds the objectives are so numerous and variable, that to enumerate them, alone, without all of their modifiers or superlatives would make a small volume.

They vary in relative importance on every "job," but two—a clean lift and good draw—are constant and always important On a very great number of "jobs" given a good lift and a good draw the mold is made.

Nothing reduces the output and lowers its quality more than bad lifts and bad draws.

What molder has not spent a lot of time plastering the sides of a pocket or projection with moistened sharp sand or fitting paper into it as the only available and certain way of insuring a good lift

Seven hours is a high average for the time jobbing molders work on their molds. If a $3.50-a-day molder has a job which takes a half hour's plastering would it not be true economy to give him lycopodium even at the present high price, if nothing else was available; but lycopodium is no longer the only sure-shot, reliable, never-miss-parting material.

Numerous substitutes for lycopodium have been offered to foundry men in

recent years. Only one out of all those tried in the shop where I work gave entire satisfaction and proved to be in every way as good as lycopodium and in one respect better.

Every molder who has used lycopodium knows that a coat of it interferes seriously with "sponging" or "spraying." If one wants to drop a little molasses water on a bead or a shoulder or a sharp corner it will roll off in the most exasperating manner.

The substitute used where I work seems under ordinary tests to have as little affinity for water as lycopodium, yet when a mold has been open for a few minutes it takes water readily.

Some of the molders at the shop insist that lycopodium gives better results on small lettering, very fine intricate carving, and on sharp grooves, beads and serrations; but my experience does not confirm this view; indeed rather inclines me to favor it on this very class of work.

There may be molders and foundry men who are not conversant with all the advantages to be derived from a judicious use of lycopodium or its substitutes. The latter to be of any practical value must approximate to lycopodium in results.

From all the jobs I have made or have seen made, where the use of lycopodium enabled the molder to make more and better castings than he otherwise could, I shall give one illustration. It was a meter base, the main casting for an electric meter made at the Westinghouse foundry, Allegheny. It was made in fine sand, was small, intricate, and a tedious job to mold. It had three legs on the cope side which had to be followed up with narrow, weak, steep bodies of sand; in the drag were two deep narrow pockets—not pockets in the pattern which are easily taken care of, but through the thin bottom of the pattern and drag sand to get at part of the pattern which had to be coped. The sides of the pocket where they passed through the sand were nearly straight, making in all about as tedious a job to part as one is apt to meet in a jobbing or machinery foundry.

The molders that made the job worked by the piece and made ten castings a day which brought them about twenty-five per cent more than the prevailing day wages.

I am certain—and all of the men that worked on the job conceded—that if they were obliged to use paper, moistened sharp sand, or any of those old expedients resorted to when lycopodium was not available, ten castings could never be made by any workman in one day.

Lycopodium was used until about a year ago when the substitute called "never stick" was introduced and has given just as good results.

The storekeeper has a small tin box which he uses as measure and scoop; it holds about a half pint which is sufficient for twenty castings or two days' work of the meter bases.

As a molder I have worked jobs by the piece where it would have paid me well—lessened the labor, saved time, increased my earnings and perhaps improved the castings—to have provided myself with lycopodium at my own expense. I hope no one will attempt to construe this into a recommendation that molders buy their own "lacky."

Now that a substitute for lycopodium much less expensive than that substance is available all that could be said in favor of the latter can be emphasized and is more widely applicable, for its small cost makes its use admissable on a class of work which would not carry the cost of lycopodium.

METALS IN FOUNDRY PRACTICE

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Malleable Iron and Steel.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

We have also made arrangements with several others to act as special contributors. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

WHITE CORE IN CASTINGS.

Question:—I am sending you by this mail a small piece of a stove skillet showing that it is chilled in the center and apparently much softer on the two surfaces. One shrinkage has suddenly become abnormally high, about .165 without any apparent cause unless it should be the manipulation of the cupola, which is the probable cause as we are melting slower than usual. According to analysis this casting should have about 3.00 per cent of silicon, but what I do not understand is its being chilled inside and soft outside, and will thank you very much for an explanation.

Answer:—This question is asked about once each year or so. The last time it was answered quite at length, giving a cut from a casting one-eighth of an inch thick and in this space were four distinct layers of a clear gray separated by three white layers making seven in all.

This casting would become solid in a few seconds and it is impossible to conceive of any influence which could cause seven distinct changes in a metal in as many seconds.

The chemical constitution is the same in the white and gray parts except that all of the carbon is combined in the white parts.

The skillet casting is simple in comparison there being one white layer between outside layers of gray, but this is the opposite of a chilling tendency of the mold which causes the surfaces to be white and the center white and which must accompany low silicon.

In this case silicon is 3.00 per cent. While I cannot explain the phenomenon I can tell how it can be produced. Catch in a green ladle some of the first 500 lbs. of iron melted in a cupola more than 36 inches in diameter and pour this into another green ladle and you will produce a white core if the iron has that peculiar tendency. The iron boils on the newly lined cupola bottom and in two green ladles.

The remedy is to throw iron from "dries" into the pig bed and not use it in molds or use for heavy work. Another remedy is to change the mixture in any way, by varying any of the irons, so as to break up the tendency to hold the carbon in the combined state, an increase or decrease of silicon will do it.

To Calculate Tensile Strength From the Transverse Strength of a Test Bar.

Question:—Can you give us a formula to figure the tensile strength on the breakage of a 1 foot square test bar which breaks transversely at 2,700 lbs.?

Answer:—There is no way by which this can be figured out from the data obtained from a transverse test. If you know approximately the silicon in the casting and have the tensile and transverse strength of various mixtures you could closely approximate. For example:

Silicon.	Trans. Strength.	Tensile Strength.
1.20 to 1.75	2,400	22,000
1.40 to 2.00	2,200	20,000
2.20 to 2.80	2,000	18,000

Approximately your casting would have a tensile strength over 25,000 pounds per square inch.

Blow Holes on Castings.

Question:—We have a great deal of trouble with castings weighing about five pounds which have hollow places near the hubs. Often you would not notice that there was any trouble with the casting until you

bore it out. We seem to have a great many castings with holes in them. These occur particularly on parts that are above the drag, coming in the cope. Our shrinkage bars show only a normal shrinkage. If it was a core blow it would naturally show a hole somewhere, but the top of the casting is perfectly smooth and yet all hollow.

Answer:—A chemical analysis of a casting might show the trouble and might not do so.

Be sure that you are using a good quality of coke and good clean scrap. Find from your broker the composition that they expect your pig iron to contain and then figuring from this do not allow your castings to contain more than .75 per cent phosphorus or more than 2.25 per cent silicon. To remedy the difficulty at once purchase one pound of commercially pure aluminum wire about ⅜ inch diameter and cut it into prices about ½ inch long. Use one piece for each 50 pounds of iron. Put it in the ladle and catch the iron on it. Your trouble will disappear. Very likely you are not pouring your molds hot enough or rather you are not melting your iron hot enough.

Be sure your sand is not too wet. If you have on hand some powdered manganese you might try about one ounce to each 100 pounds of iron in the ladle though aluminum is very much better. Don't use casting aluminum but pure aluminum.

A chill placed on the part subject to a blow hole will help sometimes. Be sure that your core mixture is not in fault.

In other words careful molding and careful melting will generally produce sound castings.

CUPOLA SLAG.

By Harry Malone.

Cupola slag is essentially a glass, and differs from common window glass only in the ingredients entering into it on one side of the equation. Window glass is formed by fusing together white sand and soda ash. It is fusible at a low red heat and when the ingredients are mixed in the proper proportions flows freely. If there is an excess of silica present the glass melts at a higher temperature and flows more sluggishly. In a similar manner fusible compounds may be formed by the union of silica with any base, silica behaving as an acid. The bases which commonly enter into cupola slags are iron oxide and lime. Alumina, or oxide of aluminum, enters the slag at times, but does not play any important part, as very little alumina enters the cupola. Silica is always present in the cupola charge and comes from two sources. First, there is the sand which adheres to the scrap, and especially to the pig iron, which is charged into the cupola. Second, there is always some oxide of silicon or silica in the ash from the coke or coal. In addition to this, a portion of the silicon in the iron becomes oxidized and also enters the slag. Slag will be formed whether the proper base is furnished to unite with the silica or not. When the proper base is not furnished in the shape of lime the silica seizes iron oxide. Some of this is always present in the oxidized surface of the scrap and pig iron, so that all cupola slags contain iron. If an insufficient amount is furnished, however, some of the iron in the charge will be burned or oxidized and thus furnish the necessary base.

It is much cheaper to use a sufficient amount of coke to insure a reducing action and to supply the base in the form of lime. This lime may be added as limestone, oyster shells, or fluorspar. When fluorspar is used another reaction takes place, as the fluorine combines with some of the slag to form a volatile compound which goes out of the cupola stack and does not enter the slag at all. Hence, when fluorspar is used, a longer heat can be taken off without tapping than when limestone is used or than when no flux is used. Fluorspar is fluoride of calcium and as soon as the fluoride is liberated to combine with the silica the remaining lime is oxidized and then acts just as an equivalent amount of limestone would. When limestone is used a certain amount of heat is absorbed in driving the carbonic acid gas out of the limestone and up the chimney. This is avoided when fluorspar is used.

Among the Foundry Supply Fraternity.

A GRAVITY MOLDING MACHINE.

A molding machine, which is unique in that it packs the sand in the flask by gravity instead of by a pneumatic or mechanical ramming, is being placed on the market by the Mitchell-Parks Mfg. Co., St. Louis. A side elevation of the machine complete is shown in Fig. 1. It comprises essentially two chain belts suspended from a pair of sprocket wheels located about 15 feet above the floor level.

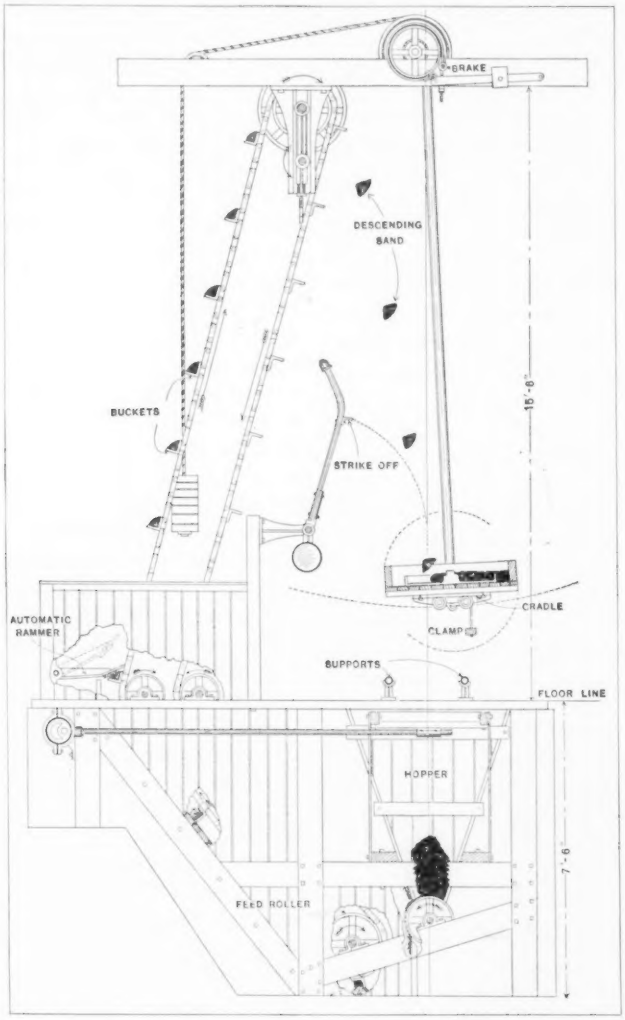


FIG. 1.—SIDE ELEVATION OF GRAVITY MOLDING MACHINE.

These chains carry buckets which descend into a boot below the floor and are there loaded with sand. The sand is then elevated, being compressed in the buckets

by an automatic rammer during its ascent and dropped a distance of about 12 feet from the top of the elevator to the flask. The flask is carried on a swinging cradle suspended from the same beams carrying the sprocket wheel shaft. This cradle can be rocked back and forth in order

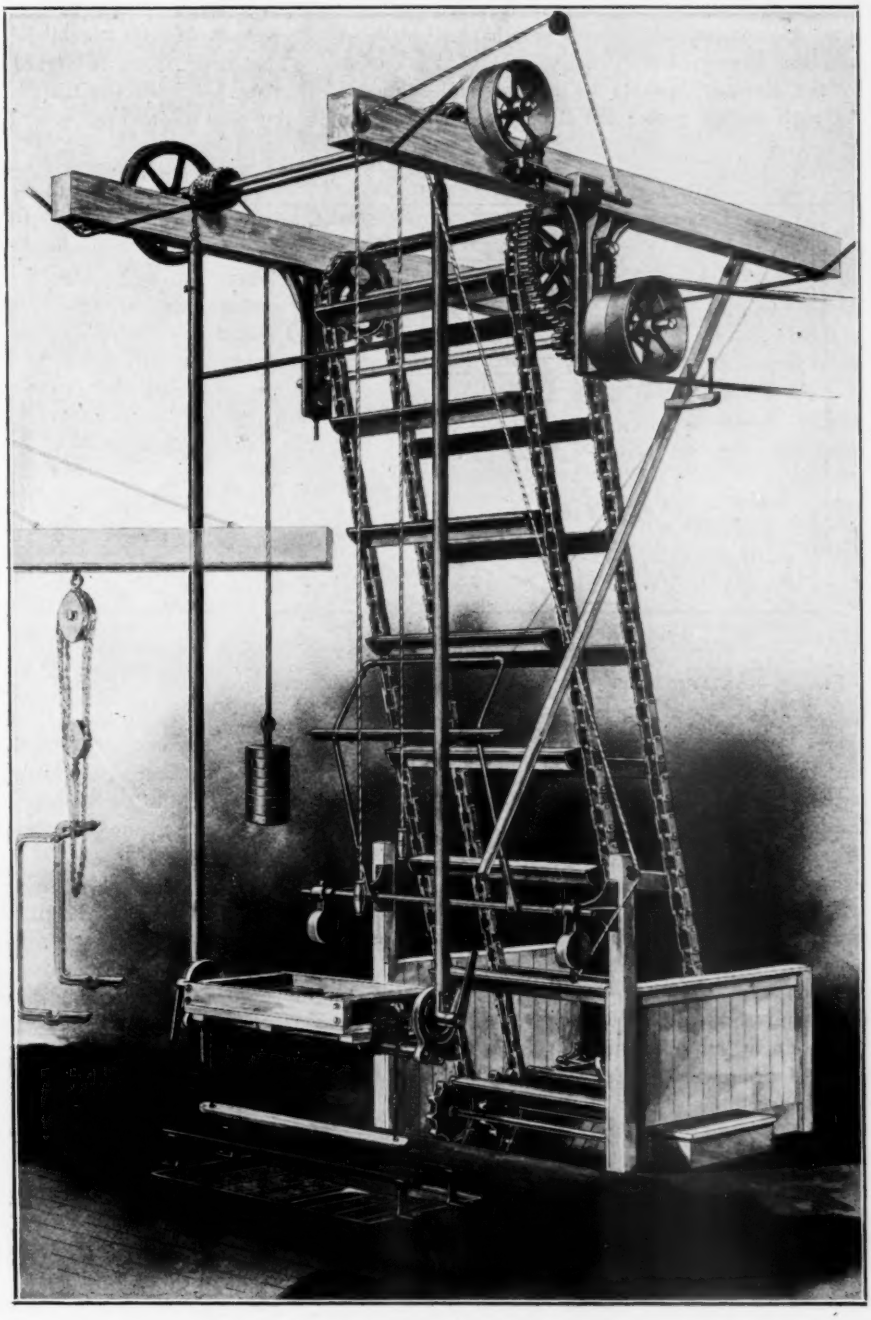


FIG. 2.—THE GRAVITY MOLDING MACHINE.

to insure an even distribution of the sand as it falls from the elevator. It is also capable of being raised and lowered in order to discharge the completed mold. Directly below the floor underneath the flask, is a hopper covered over with a shaking riddle. Sand is shoveled into this riddle, and thence discharged into the hopper, from whence it is fed to the elevator buckets by a feed roll. As each bucket passes the floor level, it comes in contact with an automatic rammer, which compresses the sand in each bucket, so that it will not disintegrate in falling, but will descend in a solid mass of sufficient body to pack firmly around the pattern and to also ram the sand below it. These bodies of sand are thrown from the elevator buckets as they turn over the head sprockets.

When the flask has been filled, a strike-off, shown in the illustration, is drawn down into position and scrapes the sand off even with the edge of the flask. The flask is then fastened firmly to the cradle by means of the clamp shown, and turned upside down and the cradle lowered, the flask being deposited upon the supporting rails directly under the cradle.

Each half of the pattern is attached to a match-board fastened to the cradle. After the flask has been deposited on the supporting rails, the cradle is drawn vertically upwards, thus withdrawing the pattern from the mold. The cradle is then raised to its working position, another flask is placed on it, and the operation repeated.

The machine is installed in the center of a floor space large enough to contain the entire output of the machine for one day. This floor space is served by means of two jib cranes situated as shown in the plan view Fig. 3. Two

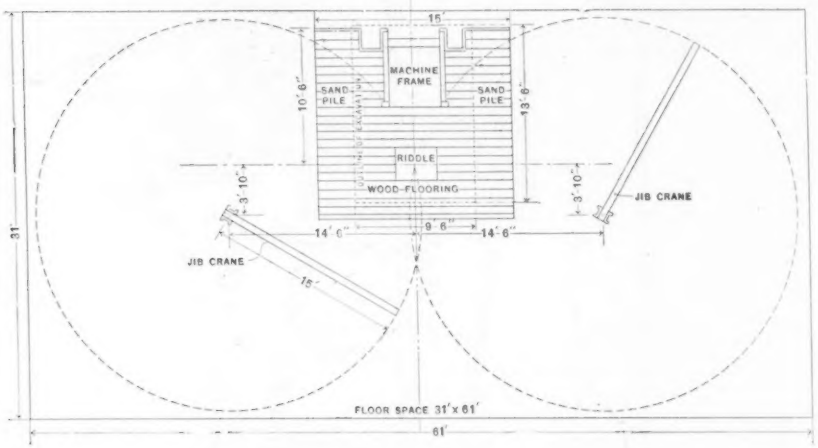


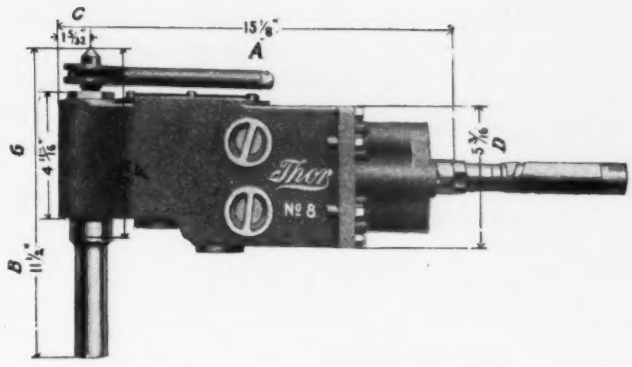
FIG. 3.—ARRANGEMENT OF FLOOR SPACE FOR GRAVITY MOLDING MACHINE.

laborers and one operator are usually required for the machine; the laborers to shovel the sand into the hopper, to bring flasks to the machine and to remove the completed mold. The sand should be tempered at night and arranged in piles on each side of the machine.

For making copes, special bails are used on the cranes, as shown in the illustration. Fig. 2, by means of which the flask can be turned and placed in position on top of the drag. Bottom-boards are clamped on the drags before they are turned in the cradle and are carried away from the machine with the flask for the purpose of supporting the sand. The cope flasks have special bars which hold the sand in place without the use of bottom-boards.

The machine is built in a varying number of sizes, ranging in capacity from a flask 22 x 30 inches up to 48 x 64

inches, and will handle any ordinary depth of flask not exceeding 18 inches. The space occupied by the different sizes of machines is the same in all dimensions, excepting width, all sizes being about 15 feet from the top of the elevator to the floor. The distance which the sand falls from the top of the elevator to the flasks in all cases is 12 feet. The firmness of the molds is regulated by adjusting the automatic compressor,



SIDE VIEW OF CLOSE QUARTER AIR DRILL.

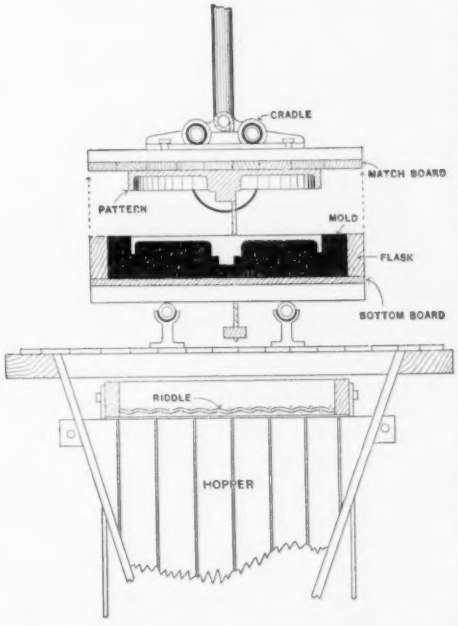


FIG. 4.—WITHDRAWING THE PATTERN ON GRAVITY MOLDING MACHINE.

and by increasing or decreasing the tension on it, so as to pack the sand in the buckets with greater or less firmness. It is stated that the pressure of the rammer can be adjusted so as to pack the molds much harder than they are ordinarily rammed up by hand. It is also claimed that one unskilled workman can operate this machine with but little practice, and that its capacity is equal to about eight hand molders. The lumps of sand drop from the buckets into the flask at the rate of over 50 a minute, thus filling a large size flask in a very short time. No stripping plates are required, and the machine can be rapidly changed from one pattern to another.

CLOSE QUARTER AIR DRILL.

The Independent Pneumatic Tool company, Chicago and New York, has just placed on the market a new drill, designed for drilling in close quarters and corners where the ordinary drill, with facility, cannot be used. The machine is illustrated herewith. It is known as the Thor No. 8 close quarter piston air drill and is capable of drilling up to 2½ inches in diameter in any kind of metal. The manufacturer bases the superiority of the drill on the ease with which it can be handled and operated, particularly its adaptability in close and cramped quarters, and the fact also that it is of very substantial construction, with no delicate mechanical parts. The distance from the throttle connection of the drill to the

TOP VIEW OF CLOSE QUARTER AIR DRILL.

outside of the spindle case, is 15 1-8 inches, and from the point of feed screw to end of socket, 11½ inches. The radius from center of feed screw to outside of case is 1 5-32 inches, and the distance from point of feed screw to end of spindle, 6¾ inches. The case at cylinder flanges is 5 3-16 inches wide and at the spindle is 4 11-16 inches wide, while the thickness of the outside of case is 3½ inches.

TRADE NOTES.

The Wilbraham-Green Blower Co., Philadelphia, recently elected the following officers: President, Edwin A. Moore; vice president and general manager, David T. Jones; secretary and treasurer, John S. Wilbraham; chief engineer, Thomas W. Green.

The Foundry Specialty Co., Cincinnati, O., manufacturer of Partine, a compound to take the place of the ordinary material used in parting molds, finds that the present capacity of its plant is entirely inadequate to supply the demands of its growing business and hence it has become necessary to make extensive additions both to the plant and equipment. The company is also sending out a very neat little catalog describing the use of Partine.

The Chicago Pneumatic Tool Co., Chicago, informs us that its sales for the past year have been between 25 and 30 per cent in excess of those for any previous year. J. W. Duntley, president of the company, who has just returned from his twenty-first trip to England and the Continent, reports that the company's foreign business is in excellent condition.

The Kobbe Co., publisher of *Compressed Air* announces the removal of its offices from 90-92 West Broadway to 108 Fulton street, New York city. The growth of the paper has made it necessary to seek larger quarters to provide for its increasing staff.

H. J. Lamborn has been made superintendent of power and plant in the Yale & Towne Works, Stamford, Conn., to succeed F. A. Waldron, who resigned about a year ago. The position is a very responsible one, involving the supervision and frequently the designing of new buildings and management of general repairs throughout the whole plant, and requires broad technical experience. Mr. Lamborn graduated from the Towne Scientific School of the University of Pennsylvania and has since filled several important positions as a mechanical engineer. S. E. Dauchy, who has been acting superintendent during the past year, will continue as assistant superintendent under Mr. Lamborn.

The Samuel M. Shime Cor., Cleveland, dealer in pig iron, iron ore and scrap, has moved its headquarters from its yard at Newburg to 36-37 Commercial Bank building.

In one day's mail recently the Millett Core Oven Co., of Brightwood, Mass., received orders for five Millet patent core ovens from London, England; Paris, France; Buenos Ayres, Argentine Republic; San Francisco, Cal., and Portland, Ore.

The late R. M. Barnett, proprietor of the Brass Founders' Supply Co., of Newark, N. J., told a very interesting story of how he happened to get into the foundry equipment business. Some forty years ago he was engaged in the ordinary foundry business and when on a visit to New York city a foundryman complained to him of his difficulty in securing flasks which would give perfect satisfaction and on the strength of this statement he received a trial order which was to be sent with the privilege to return if not thoroughly satisfactory. These flasks, however, were not like the cat, for they never came back and were the beginning of an almost endless chain of flasks which has been going out of his works ever since in a constantly increasing ratio, as he has discovered many new fields for this class of equipment and as the brass foundrymen throughout the country have learned how much better they can get along with specially fitted and accurately made flask equipment.

TRADE PUBLICATIONS.

The Ingersoll-Rand Co., 11 Broadway, New York City, has issued a catalog entitled "Imperial Type Ten Air Compressors." This is a standard size publication of forty pages, describing compressors of this type, of both steam, belt and electrically driven installations.

The Westinghouse Traction Brake Co., Pittsburg, is issuing a catalog 8½ x 11 inches, containing 12 pages, and describing the Westinghouse straight air brake equipments.

The Bristol Co., Waterbury, Conn., has issued a 30-page catalog describing the Bristol recording gauges, for various classes of work. The catalog has been entirely rearranged and made very much better for the use of those interested in this class of equipment.

The Norton Co., of Worcester, Mass., is sending out two publications, one of them entitled "Norton Grinding Wheels and Machinery." This is a standard size catalog, 6 x 9, containing 148 pages describing the many different types of wheels, grinding stones and slips, including India oil stones, which are manufactured by this company. The latter part of the catalog contains descriptions of grinding stands for various classes of work. Some of the most interesting features of the work are the descriptions of the tests of emery wheels, a statement as to the method of mounting them and some other details for the use of those interested in grinding work. The other publication is entitled "Norton Universal Tool and Cutter Grinders." This is also a standard size, 6 x 9, catalog, containing sixty pages and describing the very efficient line of grinding machinery manufactured by the Norton Co., for keeping tools and cutters in repair.

The Dayton Pneumatic Tool Co., of Dayton, O., is sending out a circular consisting of a single page folded to fit a large envelope, which is devoted to the Green pneumatic hammers. The circular is printed in two colors, and contains a table showing the different classes of hammers, and the work for which they are especially applicable.

"Uncle Billy," of the Garden City Sand Co., Chicago, is sending out a large calendar made in imitation of an oil painting. The figure is that of a woman, in sitting posture, with flowing hair. Across the top, printed in silver letters, is the name of the company, and in the lower right hand corner is the calendar for the various months.

The Motch & Merryweather Machinery Co., of Cincinnati, Cleveland and Detroit, is sending out an exceedingly useful calendar. The calendar pad proper is arranged by months, and the figures are 1 5-16 inches high, printed in good, clear black type, for the week days, and red for Sundays and holidays. Such a calendar can be seen at a fair distance, and is very useful for office purposes. At the top of each sheet there is an advertisement of some line of machinery handled by the firm.

The American Steam Pump Co., Battle Creek, Mich., is sending out a calendar consisting of a card 8 x 10 inches, on the upper half of which there is a picture of a steam pump and of the firm's works, together with a statement of the company's agencies and a few words of advertising. In the lower portion of the card there is a small calendar.

C. W. Leavitt & Co., 220 Broadway, New York city, is distributing a paper entitled "The Production of Sound Copper Sand-Castings by the Use of Magnesium." This is a reprint of a paper by Erwin S. Sperry, in *The Brass World*.

The Colonial Foundry & Machinery Co., of South Norwalk, Conn., is sending out a large wall chart illustrating the Argand boilers for steam and hot water heating. In the center of the chart there is a calendar pad, the figures in which are an inch in height.

The J. W. Paxson Co., Philadelphia, is sending out a standard size catalog of 32 pages, entitled "Foundry Ladles," illustrating all classes of ladles for handling white metal, Babbit, spelter, solder iron and steel. It includes all types in regard to pouring rig, handling devices, etc. The catalog also contains a description of slag pots, Babbit melting furnace, and some general information concerning the other material furnished by the company, such as cupolas, blowers, tumbling mills, and other equipment.

Frank L. Young & Kimball, of Boston, Mass., are sending out a very fine calendar, consisting of twelve sheets, at the top of each of which is a picture of the various warehouses and factories owned and operated by the company and below which there is a calendar for the month printed in blue and red, the figures being two inches in height. At the upper right and left hand corners of the calendar pad there are two small monthly calendars for the preceding and succeeding months, which will be found very handy in many cases. There is also above each figure small red figures representing the whole number of days from the beginning of the year, which will also be found useful in many cases. This company has been known for a great many years as large producers of oil and particularly of whale oil, fish oil, etc., and has recently gone into the core compound business.

The Sprague Electric Co. New York, is sending out a small catalog, 4 x 8 inches, describing the electric hoists and cranes made by the company. The descriptions include various types of mono-rail hoists, traveling cranes, electric winches. and other hoisting appliances.

Andrew Barclay, Sons & Co., Ltd., Caledonia Works, Kilmarnock, Scotland, are sending out a catalog containing 24 plates, illustrating, first, their works and then the various types of small locomotives for industrial works manufactured by the company. These include various types of tank locomotives for all classes of work, tender locomotives and crane locomotives. It will be noticed that these are crane locomotives and not locomotive cranes, being in reality locomotives upon which cranes are mounted as distinguished from the type developed in this country in which the engine used for operating the crane is also used for traversing it along the track, thus making a locomotive out of the crane. The machines of the type mentioned are locomotives first and foremost, but have mounted upon them cranes which enable them to do a very large variety of work.

The Ingersoll-Rand Co., 11 Broadway, New York, is sending out a catalog entitled "Catalog No. 36," describing the air and gas compressors manufactured by this company. This publication is really more than a catalog, and contains 184 pages, including descriptions of the different types of machines and also illustrations of a large number of installations showing the uses to which these machines are put. One interesting feature of the work is a discussion of the important elements of economy in the straight line and duplex types of compound air compressors. As the company manufactures both types, this statement may be taken as an unbiased statement and one which should be of great interest to all users of this style of machinery. The catalog also contains a large number of tables for the figuring of pipe lines, loss of pressure due to friction and various other problems encountered in the installation of compressed air machinery. There is a statement as to the value of reheating, also information concerning jacket cooling, intercooling and multi-stage compression. In fact, this is to a certain extent a treatise on air compression as well as a treatise on air compressing machinery.

The Western Electric Co. has issued a striking publication entitled "Hawthorne Works." On the front cover there is an illustration of the entrance to the gate of the Hawthorne Works.

This well-known company was one of the pioneers in general lighting and power machinery. As the heavier types came into vogue, however, the existing plants were not suitable for this type of construction and the capacity of the old works was devoted largely to the department of telephone and similar machinery. To meet the demand for heavier machinery a site of 110 acres was secured at the extreme west of the city of Chicago five years ago and the construction of large modern works commenced. The site has since been enlarged by the purchase of adjoining land and a number of modern buildings constructed. These include pattern shop, pattern storage and foundry, machine shop, power plant and a large group of buildings for general manufacturing purposes. The work referred to describes the new plant in detail, showing the capacity of the works, and also giving considerable valuable information concerning the motor drives used in connection with machine tools.

The Killing Molding Machine Co., Davenport, Ia., is sending out a panel calendar having a picture of a lady's head. The picture is largely a study in red, as the hair is auburn and the mantle thrown over the shoulders is red. Below the picture there is a small calendar pad.

The Thomas W. Pangborn Co., of New York, is sending out one of the most characteristic New Year's greetings which it has ever been our pleasure to see. It consists of a folder containing three leaves each 3½ by 9 inches. On the front there is a picture of two clasped hands and on the other exposed side the picture of a salesman with his hat on, extending his hand. Upon removing the clips and opening the folder it is found that the man extending the other hand is the office man, whose hat is off. Under the figures are the words—"We wish you a happy New Year." A note states "Continued on the Inside" and here a very neat typewritten statement of New Year's greeting is to be found and beneath it a brief statement of the products furnished by the Pangborn Co., which include Albany and North river molding sand, Jersey fire sand, clay and kaolin, beach core sand and sand blast sand, also the firm makes a specialty of foundry equipment. Upon the right and left pages of the inside of the folder is the trade mark of the company, which is distinctive and characteristic.

The Kerrihard Co., manufacturer of trip hammers, emery grinders and other devices, of Red Oak, Ia., is sending out a large wall calendar, in the upper portion of which there is a coaching scene and below it a calendar pad printed in red and black, the figures in which are one inch in height and printed in good, clear type. Small figures in one of the upper corners of each space indicate the number of consecutive days from the beginning of the year.

The New Era Mfg. Co., Kalamazoo, Mich., is sending out the second edition of a little booklet entitled "All about Babbitt Metals." This is 3¼ by 6 inches and contains 20 pages of matter including the treatment of the physical properties, strength, heat resisting properties and anti-friction properties of Babbitt metal, also notes on the selection of Babbitts.

The Cleveland Wire Spring Co., of Cleveland, O., is sending out a vest pocket note book, consisting of a leather cover and a detachable quadrille ruled memorandum book with perforated leaves, so that they can be torn out if desired. Inside of the front cover there is an advertisement of its steel barrels and other similar appliances and inside of the back cover an advertisement of its triple hem-steel shop boxes.

The Piqua Flour Co., Piqua, O., is sending out a leather pocket book with one large pocket for bills and four for cards. As received, one of the pockets contains a card wishing the recipient the compliments of the season and a prosperous year's business.

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When sending articles be sure to place your name and address on the article and on the drawings.

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The May Convention. Plans are rapidly maturing for the Philadelphia convention of the American Foundrymen's Association, notwithstanding that nearly four months intervene before the date of the meeting. The program, now being prepared, will abound in live topics of the utmost interest to the trade, and the papers that will be presented will record progress, unparalleled in the history of the industry. Supply and equipment manufacturers are arranging for displays, which will overshadow their commendable initial efforts at Cleveland, where they proved to be an attraction of inestimable educational value. The proposed organization of the Brass Foundrymen's Association, and the devotion of one entire session to discussions of brass foundry work, will lend added interest to the proceedings, and should assure a full attendance of those affiliated with this branch of the trade. Conjointly with the parent body, as in former years, will be held the annual meeting of the Associated Foundry Foremen; and in every way the convention promises to be one of the memorable events in the annals of the organization. Every foundryman, from proprietor to apprentice, afforded this exceptional opportunity of keeping abreast of the times, broadening his knowledge of modern practice and widening his scope of usefulness, should contribute his share towards the success of the meeting, by his presence. Employers who sent their department heads to previous meetings derived benefits incomparable to the trifling expense involved, and this practice can be profitably followed by others. The magnificent growth enjoyed by the association in the last eight months reflects expanding appreciation of its achievements, and with an increased enrollment, insuring greater financial resources, the work in the future can be carried on under circumstances more favorable than those which beset past labors. For the wonderful advancement recorded in the last decade, much credit redounds to the ef-

forts of this association, as the results of its experiments and investigations, have been unselfishly spread broadcast for the good of the whole industry, membership affiliations having been entirely disregarded.

Machinery and Equipment Displays. Indicative of a large representative attendance of foundry supply and equipment manufacturers, is the rapid allotment of space in the exhibition hall and the adjoining lot, where power machines will be shown in operation. The displays will encompass all the numerous types of tools required in equipping the modern foundry, and many manufacturers are preparing to show new appliances, designed to meet the exacting requirements of an industry that is undergoing unprecedented development. Never before has the rapid and economical production of castings received more careful consideration than at present, and the fact that improvements and extensions to many plants are being deferred to permit a more careful and more comprehensive investigation of improved methods, shows the widespread interest already manifested in this exposition. This feature, apart from the opportunities afforded at such gatherings of meeting friends and making or renewing acquaintances, should insure the presence of all seeking the patronage of the foundry trade. The Foundry Supply Association has had a rapid and satisfactory growth in membership since its organization, and the success of the convention will in large measure, be dependent upon its efforts.

Official Entertainment Program. A curtailment of the official entertainment program has been suggested to provide ample time for the presentation of papers and their comprehensive discussion. This feature, which has always been conducted on a most elaborate scale, has nevertheless crowded the regular sessions at former conventions, and the reading of many papers was necessarily eliminated. An easy solution of this problem can be had in an adjustment of this program that will insure a full attendance in the convention hall at the business meetings, and which will also give sufficient time for a careful inspection of the displays.

Trade Outlook. Lean years and low prices go hand in hand. Ten dollar pig iron recalls dark periods of the nineties, and barren foundry floors. Prosperity and high prices, likewise, travel hand in hand, and the abnormal pig iron costs, which have prevailed for nearly four months, foreshadowed the record breaking furnace output of 1906, which has been placed at close to 25,350,000 tons. The annual production has been doubled in eight years, and as compared with 1896, when 8,623,127 gross tons were made, the increment of growth assumes stupendous proportions. Notwithstanding the record breaking domestic production, the iron importation movement, shows no signs of abatement, 39,750 tons having been brought in during November, as compared with 14,999 for the same month last year and which for eleven months of 1906 reached a total of 305,416 gross tons, as against 185,890 in the same period, the previous year. For early shipment, No. 2 foundry, is quoted at $23, Birmingham, $26.50, Chicago, and $25, valley furnaces. Middlesbrough and Scotch grades are held at $22.50 and $24.50 seaboard, respectively. For shipment the last six months consumers are placing heavy contracts, southern grades of No. 2 being quoted at $19, Birmingham, northern at $22.50, Chicago, and practically the same prices prevail in the valleys. Cast scrap has not declined with other grades, as the demand has been sustained by its use, in increased proportions, in foundry mixtures.

Low Foundry Loss. Indicative of the rapid advancement in cast iron car wheel manufacture is the abnormal low foundry loss, which in the best practice rarely averages over two per cent, has reached its limit at five, and has been maintained at less than one per cent in some of the more modern plants for periods of several months. In view of the exacting requirements of the Master Car Builders, this achievement is the more wonderful, and represents progress unparalleled in any line of gray iron work. With the acceptance of the castings, other responsibilities, however, devolve upon the manufacturer. If the wheel fails, or shows undue wear before the required mileage has been attained, it must be replaced, but the losses from these causes are light. Credit for the control of the variation of the chill within the narrow limit of one-sixteenth of an inch must largely be given the chemist, as there has been little change in the construction of mechanical chilling devices in the last decade.

ASSOCIATIONS AND SOCIETIES.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The annual meeting and banquet of the New England Foundrymen's Association held at the Exchange Club, Boston, Jan. 9, will be remembered as one of the most enjoyable events of the association since its organization, eleven years ago.

The annual meeting was held in the afternoon and was attended by members from all sections of New England, while there were several in attendance from outside territory. The meeting was called to order at five o'clock by President W. B. Snow. The report of the secretary indicated a total membership of 121 firms. The treasurer reported a balance on hand and all bills paid.

The nominating committee, comprising Henry A. Carpenter, B. M. Shaw and Geo. H. Gibby, made its report for officers for the ensuing year, as follows, the report being presented by Mr. Shaw: President, Wm. H. Bense, Kinsley Iron & Machine Co., Canton, Mass.; vice president, Henry F. Arnold, American Tool & Machine Co., Hyde Park, Mass.; Secretary, Fred F. Stockwell, Barbour-Stockwell Co., Cambridgeport, Mass.; treasurer, Geo. H. Lincoln, G. H. Lincoln & Co., Boston, Mass.

Executive committee: A. L. Lovejoy, Becker-Brainard Milling Machine Co., Hyde Park, Mass.; H. E. Wetherbee, Jas. Hunter Machine Co., North Adams, Mass.; J. L. Anthony, Weir Stove Co., Taunton, Mass.; H. W. Fernald, Rogers, Brown & Co., Boston, Mass.; Wm. J. Breen, Hugh W. Adams & Son.

It was voted that the members proceed to ballot for officers for the ensuing year and the vote was unanimous for the ticket as presented.

President-elect Bense was escorted to the chair and expressed thanks for the honor conferred upon him. The following new members were unanimously elected, all having been approved by the executive committee: Androscoggin Foundry Co., Auburn, Me.; Wollaston Foundry Co., Wollaston, Mass.; Putnam Machine Co., Fitchburg, Mass.

On motion of the secretary, Mr. Stockwell, it was voted that a committee of five be appointed to look into the alleged discrimination in the matter of freight charges as applied to southern iron. The chair appointed Henry A. Carpenter, of A. Carpenter & Sons Foundry Co., B. M. Shaw, of Walker-Pratt Mfg. Co., Fred F. Stockwell, of Barbour-Stockwell Co., Arthur Gibby, of Gibby Foundry Co., and Geo. H. Lincoln, of G. H. Lincoln & Co.

Announcement was made that the February meeting of the association would be held at New Haven, Conn., and arrangements for it were left in the hands of a committee comprising the Connecticut members of the association, of which A. N. Abbe, of the American Hardware Corporation,

is chairman. The meeting then adjourned.

The banquet in the evening was more largely attended than that of any previous year, the committee of arrangements being showered with congratulations on the manner in which the affair was carried out. There were about 120 members and guests seated at the banquet tables. President Bense welcomed the guests and members in a very happy manner. He then presented Henry F. Arnold, of the American Tool & Machine Co., as toastmaster, who introduced as the distinguished guest and speaker of the evening, Hon. Samuel L. Powers, Boston, who delivered a very humorous speech which elicited frequent outbursts of enthusiasm. At the conclusion of his remarks the members were entertained by a musical entertainment which rounded out a most enjoyable and memorable evening.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The sixteenth annual meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, in that city on the evening of Jan. 2, when the officers nominated at the previous meeting were unanimously elected, with the exception that M. O. Steele and H. L. Haldeman were chosen to the places on the executive committee formerly held by H. O. Evans and R. C. Oliphant.

Speaking for the committee appointed to provide for the entertainment of the American Foundrymen's Association's convention in May, Dr. E. E. Brown reported that a meeting had been held, attended by representatives of the Foundry Foremen's Association at which good progress had been made. No definite program had been outlined, but the committee had reached a better understanding of the scope and character of the entertainment to be provided, and was in better shape to go ahead with the work. The prospects for the convention, he said, were excellent and from 1,000 to 1,500 persons were expected to attend. Already applications have been received for greater space than the Second Regiment Armory contains for exhibits, and everything points to a most successful gathering, in which the exhibits will be a very important feature. The Hotel Majestic has been chosen as headquarters for the delegates, and a monster shad dinner will undoubtedly be one of the features of the entertainment planned.

The technical paper of the evening was presented by W. O. Steele, of the Bateman Mfg. Co., of Grenloch, N. J., on "Improved Attachment for the Wadsworth Core Machine." E. J. Erlinger, dealer in foundry supplies, was elected to membership. Secretary Evans announces that an invitation had been received from the New England Foundrymen's Association to a dinner in Boston January 9, and he urged that as many as possible attend. The meeting was followed by a buffet lunch at which short addresses were made by several of those present.

Buffalo Foundrymen's Association.

John E. Gorss, Secretary, 23 Builders' Exchange.

The annual meeting and banquet of the Buffalo Foundrymen's Association were held Monday evening, Jan. 14, thirty-five members being present. It was an informal evening from start to finish and keenly enjoyed by everyone. The following officers were reelected unanimously: Lyman P. Hubbell, president; William H. Burr, vice president; George M. Trefts, treasurer; Thomas L. Richmond, Henry D. Miles, and Edward Kener, with the president and vice president, executive committee. John E. Gorss was reelected secretary by the executive committee.

The reports of the several officers showed the association to be in a most satisfactory condition and every one was interested in the report of the work accomplished. O. P. Briggs, president of the National Founders' Association, was the guest of honor and spoke on the subject of education among men in the mechanical departments of foundries. He expressed in no uncertain terms the necessity of en-

lightening the employes, arguing that it would bring about a better condition in the shops and less friction. O. P. Letchworth followed with a speech in which he endorsed the sentiments for better education of foundry employes. Secretary Hutchins, of the National association, also addressed the foundrymen, reviewing the situation and taking up the educational problems principally.

British Foundrymen's Association.

F. W. Finch, Kingston House, Lonsdown Rd., Gloucester, Eng., Secretary.

A meeting of the Birmingham branch of the British Foundrymen's Association was held at the Technical School, Birmingham, on Saturday, Dec. 15, when there was a large and representative attendance, under the presidency of Mr. R. Buchanan, the Birmingham president. A paper had been announced to be given by Mr. P. Longmuir, Carnegie Gold Medallist, on "Molding Sands," but the subject was changed. The reason for this was given by the chairman, who explained that Mr. Longmuir had not been able to carry the subject further than in the paper he gave at Glasgow. The chairman remarked that those who heard the Glasgow paper at the Foundrymen's conference greatly enjoyed it, and were not surprised to hear that no further progress had been made. Mr. Longmuir was known as a voluminous writer on metallurgical and foundry subjects, and probably no man in the British islands had contributed more in recent years on those subjects. He united in himself practical and scientific qualities having worked as a molder, and studied for theory at the Sheffield Technical college under Prof. Arnold. His duties there led him up to the Carnegie Scholarship, and the scholarship led him to the silver medal. He was now a professional metallurgist, and a great authority on alloys of steel, of which they had been hearing so much in recent years.

Foundry Problems.

Mr. Longmuir announced as his subject, "Two Foundry Problems," remarking that "wasters" as a whole were more or less a problem. Enumerating the series of governing conditions, the speaker said the success or otherwise of iron, steel, or brass sand castings were broadly as follows:

1.—Composition of metal or alloy.

2.—Method of melting, change of composition, absorption of oxide, influence of gases.

3.—Initial casting temperature.

4.—Preparation of molds.

5.—Presence of blow-holes, foreign matter, sand, slag, etc.

6.—Shrinkage faults, inefficient feeding.

7.—Contraction faults.

8.—After treatment—in the case of white iron and steel.

The speaker said he proposed to deal with only two of those problems, the absorption of oxide, and the initial casting temperature. Wasters as a rule represented a violation of one or other of the foregoing conditions. Faulty molding was shown in the result in casting, and unsuitable composition was shown by analysis of the casting. In the majority of cases, the cause of the waster might be ascertained by (1) examination of the casting, (2) by chemical analysis, and (3) by microscopic examination, but there were certain wasters not thus explainable, and these mysterious failures might be explained by oxidation, and the retention by the metal of the resulting oxide, or by varying casting temperature. The speaker said that the retention of oxide by metals or alloys is a problem of very direct interest to founders, and examples were taken from pure iron, copper, and nickel, where the oxides are retained, and also from zinc, where the oxide is emitted. Examples of the use of the oxidizers were given, and emphasis laid on the fact that any loss of zinc present in an alloy should be made good before casting.

A series of tensile tests results were

given showing that for all alloys in metals there is a certain casting temperature at which alone the full properties are obtained. Castings poured above, or below this heat invariably had lower mechanical properties and offer less resistance to the passage of steam or water under pressure. The following results are typical of the tests given, and show the variations in properties due to varying casting temperature:

Analysis.

Copper.	Zinc.	Casting temperature. Degree Centigrade.	Maximum Stress Tons per sq. in.	Elongation Per Cent on 2″.
89.6	10.2	1308	6.8	13.2
		1073	12.6	26.0
		1058	5.7	5.5

The only variable in this, and other samples quoted was that of initial casting heat, and in the case of white iron and steel the speaker showed the persistence of the variation through heat treatment.

The chairman pointed out that Mr. Hiorns who was with them was a great authority on the subject of copper, and would no doubt be able to enlighten them on the copper question.

Mr. A. H. Hiorns said that the paper had been much more instructive and interesting than anything on molding sands could have been. Copper was too big a question to go into. He understood that with various alloys they got totally different mechanical results, when metals were cast at different temperatures. He would like to know precisely what Mr. Longmuir supposed took place which caused those very diverse results. They could understand the different result at the high casting temperature, but they also got a still lower result in the low casting temperature. The same thing could not take place in those two totally different conditions. It was quite true that in the medium condition they got the most excellent result in many cases. He would like to know also whether the castings were in sand or in metal molds. Another question was suggested by the re-crystallization of lead, which restored it to normal conditions. In Birmingham they were acquainted with the sudden breaking of brass articles, such as chains, or chandeliers, which broke off either when in use or in the stores, without apparent cause, and were found to be crystallized. Did Mr. Longmuir mean that crystallization strengthens metals or was that remark applicable only to the case of lead? The great merit of the paper was that the information was original, and obtained at first hand, and he had been greatly instructed by it.

Mr. F. J. Cook said the lecture was one of the best he had ever listened to and was practical right to the bottom, but he would like to know whether there was any difference in the oxides at high temperature and low temperature. He would like to know also what instrument was used for taking temperatures. They badly wanted a workable instrument practicable in the iron and brass foundries. That would be an important step towards dealing with that complex question. Electrical instruments were practically out of the question, but he would like to have his ideas on the question of optical instruments.

The chairman said he would like to ask a question. They sometimes read in the technical press about the addition of an oxide of this or the other metal. He was in a foundry the other day when it was suggested that there should be an addition of the oxide of titanium, because certain results would follow therefrom, but a difficult problem to him was how to arrange that the oxide should join with the iron, or would it pass away with the slag. He was not clear as to the probability of such dis-association taking place. He remembered many years ago adding oxide of manganese to cast iron, and expecting it to make it better, but so far as he ascertained he thought it was rather the other way. He would like to know whether the oxygen and the metal were dis-associated, or whether the oxygen joined the bath of metal, and whether such ef-

fects were readily got, if got at all.

The question of varying results from varying temperatures had a good deal of mystery about it, and was like that question of shrinkage in some respects, and was one of those things no fellow could understand. His own experiments went to show that casting as hot or almost as hot as one could get iron from the cupola gave the best results as regards its strength. He had made some experiments of a rather mixed character, but the varying results he thought were due not so much to the variation in casting temperature as to the different rate of cooling. He cast some large levers weighing thirteen hundred weight, some test bars of which broke at 34 cwt., and others at 26. His own explanation was that the difference in the rate of cooling increased the size of the crystals, and so they had to consider the casting temperature, plus the rate of cooling. Those were the things that helped to make foundry work so interesting, but also so tantalizing, as it was occasionally. Probably, the remarks Mr. Longmuir made about the continuance of results in the case of cast iron were the most extraordinary. It might be that the oxides had something to do with it, seeing that the malleable castings were annealed in iron ore. It was extraordinary that the results should be seen in a casting previous to annealing, and then should stand annealing for 100 hours at a temperature of 900 degrees centigrade, and that the result should still subsist through all that treatment.

Mr. Percy Longmuir, replying, said that various interesting points had been raised. He preferred not to state any theories as to his results showing inferior castings both from very high, and very low temperatures. The facts were beyond doubt. Metallurgy as a science had suffered from immature theories, and it was their duty not to add to the number, unless something definite could be given. Every pure metal seemed to have a particular temperature at which the best result in crystalline cohesion was developed. If they took pure iron, pure copper, and pure lead, and examined the crystal junctions they found that as the heat approached what was called fair casting heat the junctions were narrow, and the crystals dovetailed one into the other. At high temperature, they appeared loose, and not holding firmly against each other. Under magnification the whole thing looked to be lacking in grip, while at low casting temperatures the crystals had distinct spaces between certain junctions. That was when four hundred to five hundred times magnified. That explained why castings should leak. If the different constituents were dovetailed one into the other, there was no interstice between each crystal. In such cases, where the casting was subjected to test, the loose crystals offered an opening for water. With low heat they only needed an aggregation of loose spaces, for water to get through. In the admiralty alloys, referred to in his account of experiments the difference of cohesion in high and low temperature castings was very marked. In the case of white iron he got very similar results. The pearlite and cementite seemed to be separated more sharply from each other in the high temperatures. It was evident that metals had a certain critical temperature from which they should cool, and which was the most suitable, which produced the strongest and the most interlocked crystals. As to the position of the castings they were all produced in sand and the same height of runner. The other metals were cast on the flat and the steel in a vertical position. He was perfectly confident that the only variable was the casting temperature. With regard to the case of chains breaking in the stores he could not understand that. But with regard to the crystallization of lead it appeared that through the annealing the elongations increased over what they were before. He would not like to say that recrystallization was a good thing. He did not think

it was, but in the case of lead it restored the elongation. Recrystallization in the case of another metal might be dangerous. With regard to Mr. Cook's points he did not believe much in the absorption of oxide of iron, because if they took the Bessemer Converter as an analogy the first materials to be oxidized were the manganese, the sulphur and the carbon, while iron was the last, which showed a sort of preferential affinity. They knew that Dr. Moldenke was very strong on the presence of oxide of iron in the cupola. They could not help thinking there was some affinity between the high driven blast furnace, and the oxide. The modern blast furnaces were notoriously high driven, and they might tend to produce oxygen or oxide in the iron. That might explain the preference that many foundries have for iron from small blast furnaces. A gently worked furnace did not take oxide while a rapidly driven one would. If the cupola was properly worked the temperature could not be excessive, and in a commercial foundry he did not think heats were generally too high. There would be very little variation unless the iron was specially heated. In cast iron they got all sorts of results and all sorts of variations, but the persistency of the results in the malleable product was truly remarkable.

The chairman, proposing a vote of thanks, pointed out that moulders got accustomed to a fair casting temperature because they knew they got the best results and they consequently refused to cast either too high or too low.

The vote was carried with acclamation, and Mr. Longmuir in acknowledging, said he did not think any member of the Foundrymen's Association had profited more than he had from its operations, and if ever he was within reach of Birmingham, on the occasions of future meetings, he would be found in that room.

Philadelphia Foundry Foremen.

W. P. Cunningham, Secretary, care American Bridge Co., Pencoyd, Pa.

At the monthly meeting of the Philadelphia Club of Associated Foundry Foremen held at Royal Arcanum hall, Philadelphia, Monday, Jan. 14, E. E. Mumford, of the E. E. Mumford Co., presented a paper entitled "Rathbone Multiple Molding Machine," which was illustrated with lantern slides.

Cleveland Club of Associated Patternmaker Foremen.

H. J. McCaslin, care Wellman-Seaver-Morgan Co., Secretary.

The regular January meeting was held Monday evening, Jan. 14, with a good attendance. The annual election of officers was held and Alfred Hibbs was elected president, Fred Abell, vice president; H. J. McCaslin, secretary and treasurer. Jabez Nall and Otto Neuert were elected members of the board of management. After the transaction of the regular business H. M. Lane gave a report of the progress made in connection with the American Foundrymen's Association convention to be held in Philadelphia, May 20 to 24. Mr. Nall then read a very interesting paper entitled "Saving Time in the Core Room," which was illustrated with several drawings, including methods of molding a cone pulley. The paper was discussed by all present. The members then discussed the advisability of preparing a general paper for presentation to the American Foundrymen's Association along lines similar to the one presented at the Cleveland convention. Several subjects were proposed and members promised to bring in matter upon them for general discussion, so as to compile a composite paper or a series of papers presented by the club or its members.

AMERICAN FOUNDRYMEN'S ASSOCIATION.

Dr. Richard Moldenke, Secretary, Watchung, N. J.

PACIFIC COAST FOUNDRYMEN'S ASSOCIATION.

J. D. Morris, Secretary and Treasurer, Seattle, Washington.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co., West Carson Street.

FOUNDRY SUPPLY ASSOCIATION.
H. M. Lane, Schofield Bldg., Cleveland, Ohio, Secretary.

THE ASSOCIATED FOUNDRY FOREMEN.
Frank C. Everitt, care the J. L. Mott Iron Works, Trenton, N. J., Secretary.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
W. S. McQuillan, Sec., The Colonial Foundry Co., So. Norwalk, Conn.

CLEVELAND FOUNDRY FOREMEN.
H. M. Lane, Schofield Bldg., Secretary.

CINCINNATI FOUNDRY FOREMEN.
E. W. Cadwell, Secretary, care S. C. Tatum Co

CHICAGO FOUNDRY FOREMEN.
C. J. Wiltshire, Sec., Western Electric Co., Chicago, Ill.

ERIE FOUNDRY FOREMEN.
W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

INDIANAPOLIS FOUNDRY FOREMEN.
W. S. Keller, of Hetherington & Berner Co. District Vice President.

HAMILTON, ONT., FOUNDRY FOREMEN'S ASSOCIATION.
A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

BRITISH NOTES.

An interesting new departure has been made by Messrs. W. and T. Avery, the famous weighing machine makers, at their works Soho foundry. This firm it will be remembered attracted some attention a few months ago by the announcement of their intention to establish in America a branch of their works with the object of meeting American competition. The firm have now initiated an air-gun club at the works with a possible view of recruiting miniature rifle clubs. The men have decided to carry out rifle practice during the dinner hour, which, as the firm suggests, is often spent in a less profitable manner. Messrs. Avery provide the air guns, and the matter has been taken up so enthusiastically that the club has now a roll of over 500 members. The profits are to be devoted to the works' sick club, and for the first three months these have totalled over £20. The firm have just declared an interim dividend for the six months of 5 per cent on ordinary shares.

Very great sympathy is expressed with Mr. A. H. Hiorns, the well-known metallurgist, in the loss of his eldest son, which recently took place. There were several references to the sad event at the annual dinner of the Birmingham Metallurgists' Society. Mr. Hiorns is one of the most modest and retiring of men, but his personal qualities are, properly, appreciated all the more on that account. Prof. Heath mentioned the fact that Mr. Hiorns founded the society three years ago, while Prof. Turner mentioned that he first heard of anthracite coal at a lecture given by Mr. Hiorns, and that they had been in touch ever since. The Professor added that there was no rivalry between Mr. Hiorns and himself in spite of the fact that they were both teaching the same subject. If the university and the technical school were taken together as branches of one institution, he thought their work would compare very favorably with that done in any other town.

The Birmingham iron founders have found it necessary owing to the high prices of foundry pig iron, and especially of cold blast iron, to increase the prices of finished articles, namely, chilled rolls by £1 per ton, and grain and groove rolls, and other castings 10 shillings. The foundries are full of work, and are likely to be very well off for a long time to come owing to the demand in the way of plant renewals by the finished iron works, especially in South Staffordshire. But some castings are also being turned out for the great centers in the north of England, where the large cogging machinery, and especially the ordinary mill plant is largely obtained from the Midland district. Much satisfaction is expressed at the continued immunity from labor troubles of all kinds.

A notable development in connection with foundry work is the increasing use of electrical energy, especially for grinding purposes. Electricity is now supplied very cheaply in Birmingham, and foundrymen have long been aware that the grinding wheel is a very valuable aid for finishing purposes. By its means very

hard surfaces can be dealt with, and may be said to have led the way for makers of machinery, drills, and various kinds of tools, which can be finished in this way more advantageously than with cutting machines. Among the local firms that have recently adopted electricity are Messrs. Rigley & Co., Foundry Lane, Smethwick, Messrs. Guest, Keen, and Nettlefold, and the Birmingham Carriage & Wagon Co., Ltd.

PERSONALS.

W. N. Sawyer, has resigned as general manager of the Lake Superior Corporation to become general manager of the Wellman-Seaver-Morgan Co., of Cleveland, taking the place made vacant over a year ago by the death of Charles H. Wellman. Mr. Sawyer was formerly connected with the Wellman-Seaver-Morgan Co. as engineer of steel and rolling mill works and later as manager of its Pittsburg office.

T. B. Walsh, for the past 28 years superintendent of the Frost foundry at Galesburg, Ill., retired from active connection with the plant Jan. 1. He still continues a director of the company.

A. B. Holmes, who has occupied the position of secretary of the Independent Pneumatic Tool Co., Chicago, has also been elected treasurer and will assume his dual duties on Jan. 16.

DEATHS.

Andrew Corbin, brother of Philip Corbin, president of the American Hardware Corporation, and one of the builders of the large industry of P. & F. Corbin, hardware manufacturers, died at New Britain, Conn., Jan. 4, at the age of 83. In 1853 he became identified with the P. & F. Corbin Co., and in 1872 became general manager of the factory at New Britain, a post he held throughout the remainder of his active business life.

John Sellers Jr., member of the firm of William Sellers & Co., Inc., Philadelphia, a director of the Midvale Steel Co. and president of the Millbourne Mills Co., died at his home in Millbourne, Pa., Dec. 15, aged 86 years. He was one of the founders of the Union League of Philadelphia.

Dan V. Doran, for twenty years associated with Matthew Addy & Co., at St. Louis, died of catarrh of the stomach on Jan. 7. Beginning as an office boy he worked himself up to an interest in the company and was one of the most popular salesmen in the territory. He was known from Cincinnati to Kansas City and from Chicago to Birmingham. He was 34 years old and married.

Abraham R. Ludlow, a pioneer citizen and manufacturer of Springfield, O., died at his home in that city Jan. 2. at the age of 80 years. He was a member of the firm of Ferrell, Ludlow & Rodgers, manufacturers of farm implements, which was later merged with the American Seeding Machine Co. He was for many years the head of the Springfield Malleable Iron Co., from which he retired about a year ago, and had been prominent in the public affairs of Springfield.

Robert Vierling, president of Vierling, McDowell & Co., Chicago, died Dec. 20, at the age of 54. Mr. Vierling received his early education in the Chicago public schools, and was soon after employed by the old Union Iron Works. In 1881 he organized and became president of the firm of Vierling, McDowell & Co., founders and structural fabricators, with which he has been identified for the past twenty-five years.

Geo. W. Remington, president of the Remington Machine Co., Wilmington, Del., died Dec. 12, at the age of 67. He leaves a widow and two daughters.

Solomon Finley, until a short time ago secretary of the Howard Iron Works, Buffalo, died Dec. 17 at his home in that city. He was born in 1839 and for 47 years was connected with the Howard works.

Samuel T. Bleyer, founder and former president of the Hawley Down Draft Furnace Co., Chicago, died on Wednesday, Dec. 19, after a long illness. Burial was made at St. Louis.

James Thomas, president of the

Davies & Thomas Co., Catasauqua, Pa., died Dec. 18 at the age of 75. He was general manager of the Irondale & Eureka Iron Co. in Alabama in the early seventies, being identified with the manufacture of the first coke iron in that section. He became connected with the Davies & Thomas foundry in 1879.

Watson G. Moody, for fifteen years resident manager of the Boston office of Rogers, Brown & Co., died Dec. 21, at Idlewild, Rye, Colo., where he had gone some time ago for his health. He possessed a large circle of social and business friends, particularly in the New England states, where he was held in high esteem. His wife and two children, who survive, will remain at Rye indefinitely.

Patrick J. Flaherty, superintendent of the brass foundry of William A. Hardy & Sons Co., Fitchburg, Mass., died Dec. 16, at the age of 38.

Edwin G. Crawford, vice president of the Carondelet Foundry Co., St. Louis, died Dec. 19, of pneumonia, aged 51 years. Mr. Crawford was born in Madison, Ind., and had been engaged in the foundry business for 30 years, having been connected at various times with the National Malleable Iron Co., of Indianapolis, the Indianapolis Foundry Co., and for the past 17 years with the Carondelet Foundry Co.

Ross Watt, president of the Watt Mining Car Wheel Co., Barnesville, O., died Dec. 22, after a short illness.

James Clayton, a pioneer manufacturer of air compressors, died at his home in Brooklyn, N. Y., recently. Mr. Clayton came to America fifty-seven years ago, and began the manufacture of air compressors about 1865.

FIRES.

A loss of several hundred dollars was caused by a fire in the foundry department of the Atlas Mfg. Co., Fostoria, O., Dec. 28.

Fire of unknown origin caused damage estimated at $60 000 to the plant of the American Car & Foundry Co., located at Depew a few miles east of Buffalo. The buildings were formerly occupied by the Union Car Works.

The foundry department of the Bretting Iron Works, Ashland, Wis., was destroyed by fire on Dec. 19.

The plant of the American & British Mfg. Co., of Providence, R. I., successor to the Corliss Steam Engine Co., sustained a heavy loss by fire on Dec. 5.

The foundry and machine shop of H. W. Ollig, at Winthrop, Minn., was destroyed by fire on Dec. 20. Mr. Ollig estimates his loss at $9,000 or $10,000, on which he carried $5,000 insurance. The plant will be rebuilt in the spring.

NEW CONSTRUCTION.

The D. & W. Fuse Co., Providence, R. I., is to erect a one-story structure 40 x 70 feet, of brick and steel, to be used for foundry purposes.

The Lumsden & Van Stone Co., 69 High street, Boston, is planning to erect a large machine shop, foundry building, brass turning shop, and storehouse for patterns.

Landers, Frary & Clarke New Britain, Conn., have contracted for a new annealing shop, one story, 30 x 50 feet, also an addition to their die vault.

Taylor & Co., of Brooklyn, N. Y., will erect a two-story brick extention to their foundry, 117 x 120 feet, to cost $6,000.

The Chambersburg Engineering Co., Chambersburg, Pa., is to issue $200,000 in bonds to pay for improvements now being made at its plant. The new construction work includes a large steel foundry.

The Indiana Foundry Co., Indiana, Pa., will make an addition to its machine shop, doubling its present capacity, and later on will enlarge its foundry.

The Central Steel Casting Co., Columbus, O., has been incorporated with a capital stock of $100,000 by John L. V. Bonney, W. B. Floyd, K. E. Burr,

John Rogers and P. B. Monypeny. A tract of twelve acres has been secured in the southern part of Columbus, and plans are being prepared for the new plant, which will include a foundry, power house, cleaning and shipping departments and office building.

The Standard Pulley Co., Cincinnati, manufacturing pulleys and clutches, has broken ground for a new plant which will triple its present capacity. The foundry will be 100 x 200 feet and the machine shop 50 x 238 feet.

The Marion Malleable Iron Co., Marion, Ind., has lately added two large buildings to its plant, one of which is to be used for a foundry. The company will increase its working force to 600 men on Feb. 1.

The Baugh Foundry Co. is being organized at Alliance, O., to take over the present foundry of Frederick Baugh and to erect a modern plant in that city.

Langsenkamp & Wheeler, Indianapolis, Ind., have taken out a permit for an $8,000 addition to their brass foundry, contract for which has already been let.

The Hildreth Mfg. Co., Lansing, Mich., is remodeling the plant of the Lansing Foundry Co., which was purchased by the Hildreth company at the time of its reorganization.

Charles Maynard, Milwaukee, Wis., has taken out a permit for a brick foundry to cost $4,000.

The Washburn Co., Minneapolis, Minn., will erect a new foundry building, 60 x 400 feet, on which work will be started about April 1. The plant will be operated by electricity and one 20-ton basic open-hearth furnace and one 15-ton acid furnace will be installed.

The Peninsular Motor Co., Grand Rapids, Mich., is planning a new foundry, 50 x 118 feet.

The Riverside Foundry Co., Kalamazoo, Mich., is erecting an addition 40 x 56 feet.

The Gardner Valve Mfg. Co., 95 Liberty street, New York, is planning to erect a plant at Hampton Junction, N. J. This will include a one-story iron foundry, 70 x 200 feet, a two-story brass foundry, 45 x 50 feet, and a two-story machine shop, 72 x 150 feet.

The Myers Pump & Mfg. Co., Bliss, Okla., will manufacture pumps and air compressors. Full machine shop and foundry equipment will be required. The company states that Bliss is only a temporary location and that eventually the factory will probably be removed to another city.

The Davenport Locomotive Works, Davenport, Ia., has purchased a tract of 27 acres adjoining its plant to provide for future extensions. A new foundry, 90 x 160 feet, will soon be erected.

Dr. Frederick J. Wearne, proprietor of the Wearne Foundry, of Omaha, Neb., will next spring add a three-story brick foundry building to his present plant.

The Amherst Malleable Iron Co., Ltd., recently began operations at Amherst, N. S., in its new plant, including a brick and stone structure 65 x 264 feet, also boiler and engine rooms, office and pattern storage building, and some smaller buildings. A melting furnace with a daily capacity of 15 to 20 tons is in operation and the plant is provided with two double annealing ovens with a capacity of 12 to 14 tons of annealed castings per day. N. Curry is president and George S. Crossman, secretary and treasurer.

GENERAL INDUSTRIAL NOTES.

The Valley Falls Iron Foundry, Inc., Salem, Mass., has been organized with a capital of $10,000 to deal in iron. The incorporators are William S. McIntire, Frank W. Delano and Elizabeth McIntire.

The John Pirkl Foundry Co., Brooklyn, has been incorporated with a capital stock of $100,000 to manufacture iron and brass castings. The incorporators are John Pirkl, G. L. Schnepp and Henry H. Hull, all of Brooklyn.

Walter Vosbury, heretofore one of

the partners of the Deposit Foundry Co., Deposit, N. Y., has purchased the interests of the heirs of the late Geo. M. Ballard, and is now sole owner.

The Baltimore Railway Specialty Co., of Corning, N. Y., began active operations in its new plant on Sept. 19, and hopes to have it running to its full capacity in the near future. The foundry is equipped with 30 Adams' squeezer molding machines and other special appliances. A 15-ton air furnace is used for melting for the malleable department. Both hard and soft cleaning departments are equipped with Sly mills of the exhaust pattern. There are several annealing ovens, and everything is of the most modern construction. The malleable plant is in charge of Robert R. Barringer, who has had extensive metallurgical experience.

The United Engineering & Foundry Co., Pittsburg, has purchased outright the plant of the Mahoning Foundry & Machine Co., Youngstown, O., together with eight acres of land, with the intention of increasing its iron foundry facilities and also of establishing a steel casting foundry in that district. This plant will be operated as a part of the Lloyd-Booth department of the United Engineering & Foundry Co.

The K. D. Q. Mfg. Co., Cleveland, O., has been organized with a capitalization of $10,000 by S. Q. Kerruish, George Quayle, Jacob Diehl, William Kenyon and James Quayle, and will manufacture patterns, machinery and tools.

The Marion Foundry & Machine Co., Marion, O., which recently purchased the plant of the defunct Edison Foundry & Machine Co., has organized by electing Louis Watzel president and general manager, Charles Reiger vice president and Harry Noll, secretary and treasurer.

C. G. Robinson, formerly superintendent of the Steel Foundry Co., Cincinnati, has returned to that city and is engaged in organizing a new company to manufacture small steel castings.

The Calumet Engineering Works has been organized with a capital stock of $250,000, to take over the plant and business of the Harvey Foundry & Machine Co., Harvey, Ill., and will carry on a general jobbing foundry and machine shop business. The plant has been enlarged and modernized and electrically driven tools and appliances have been installed in the foundry, machine and structural shops. The plant occupies eight buildings on a tract of 5½ acres, and includes a pattern shop, 40 x 90; pattern vault, 70 x 110; foundry, 107 x 136; foundry cleaning room, 40 x 60, besides blacksmith, machine and structural shops, engine room, etc. Gray iron, semi-steel and steel castings will be made.

H. W. Leavitt, of Urbana, Ill., has sold his interest in the Leavitt foundry to A. S. Mason, of Alexandria, Minn.

The Savill-Chandler Co., Canton, Ill., recently incorporated, takes over the business formerly conducted under the name of J. M. Savill & Sons, manufacturers of mining cars and supplies, founders and machinists. The company is considering the enlargement of its plant, though definite plans have not yet matured.

The Missouri Malleable Iron Co., East St. Louis, Ill., has elected the following officers, changes in its staff having been made necessary by the death of its president, John C. Nulsen: F. E. Nulsen, president and general manager; A. J. Nulsen, vice president; H. L. Baur, secretary; D. G. Rhoades, assistant general manager, and Henry Berkemeyer, treasurer.

The La Valley Mfg. Co., Milwaukee, Wis., incorporated with a capital of $50,000, proposes to erect a steel foundry building. The incorporators are C. W. La Valley, Donald Fraser, William C. Sargent and William C. Frye.

The departments of the Allis-Chalmers Co., which were located at the

Reliance works on Clinton street, Milwaukee, have been moved to the West Allis works.

The Wheeling Mold & Foundry Co., Wheeling, W. Va., announces that its Pittsburg address is 823 Farmers Bank building.

The Orleans Metal Bed Co., New Orleans, La., and Hanna & Kalmbach, of the same city, have consolidated under the name of the Orleans Metal Bed Co., Ltd.

The McWane Pipe Works began operations at Lynchburg, Va., four years ago, with a capacity of from 12 to 15 tons per day. The business has increased so rapidly that the Lynchburg plant has had to be increased to four times its original capacity and the plant of the Radford Pipe Works, at Radford, Va., has been purchased, the latter plant having a capacity of 125 tons per day.

David C. Beaman retired as a director of the Colorado Fuel & Iron Co., at the annual meeting of the stockholders in Denver, Colo., Oct. 15, and Robert C. Clowry, of New York, was elected his successor. With this exception the old board was re-elected. Mr. Beaman will continue to serve as secretary and general counsel of the corporation.

A. A. Koch, manager of the Vulcan Iron Works, Mason City, Ia., has disposed of his interests to Ira Knapp, who thereby becomes sole owner.

The Montreal Steel Co., Montreal, Can., will increase its capital stock to $2,000,000 in order to provide for extensions. It will erect a plant for the manufacture of manganese castings and will extend a number of its present plants.

H. B. Fargo, of the Geneva Foundry & Machine Co., Geneva, Ill., has sold his interest in that concern to G. R. Sperry, of Batavia. At a meeting of the stockholders, Mr. Sperry was elected president of the company and will at once take charge of the shops.

The Wambold-Brunschweiler Co., Milwaukee, has been incorporated to conduct a foundry and machinery business. The capital stock is $30,000, and the incorporators are: H. E. Wambold, George W. Brunschweiler and Orrin Thompson.

The Saginaw Semi-steel Iron Works, Saginaw, Mich., is erecting a foundry for the manufacture of iron castings. The partnership includes William Crowley, for 17 years foreman of the Bay City Industrial Works, his son, and J. W. Mount, of Bay City.

The Benton Harbor Development Co., Benton Harbor, Mich., has secured the location of the Benton Harbor Malleable Foundry Co., in that city. A bonus of $10,000 and a foundry site have been given the new company, which will at once begin the construction of a large plant for gray and malleable iron castings. G. S. Burtis, of Chicago, is at the head of the company.

I. N. Conrad is moving his foundry from Mt. Pleasant, Mich., to Hillsdale, Mich.

The Hewitt Mfg. Co., Milwaukee, Wis., has been incorporated with a capital stock of $100,000 by Charles H. Duback, Charles H. Schoff and William E. Liebau. C. M. Hewitt will be president of the company, which takes over a long established brass and bronze foundry business.

The Michigan Stove Co., Detroit, announces that its fire of Jan. 8 did not injure the foundries, power plant, or manufacturing buildings seriously, the heaviest loss being in the storage plant, a portion of which was completely destroyed.

The Johnson Machine Works, Battle Creek, Mich., has been reorganized under the name of the Anderson Foundry & Machine Co., and will manufacture engines and machinery. The capital stock is $100,000, and the incorporators are: Thomas B. Anderson, James B. Catteau and Syra E. Lewis, all of Battle Creek.

The Elite Foundry Co., Milwaukee, Wis., has been incorporated with a capital of $10,000 by John Houdek, Antoine Dishneau and E. I. Dishneau.

The Peerless Foundry & Process

Co., Mead street, Trenton, N. J., has been incorporated to manufacture iron castings, steel, copper, etc. The capital stock is $50,000, and the incorporators are: Fred M. Stapler, Mead street, Trenton, N. J.; Nelson Veno, 406 East Fourth street, Flatbush, N. Y.; Adolph W. Brunn, Hackensack N. J.

The Marcy Stove Repair Co., Perth Amboy, N. J., has been incorporated to manufacture castings, stoves, etc. The capitalization is $36,000, and the incorporators are: O. Denis, A. E. Hauser and A. Gross, of Perth Amboy.

The Sheffield Casting & Mfg. Co., Sheffield, Ala., has been incorporated with a capital stock of $50,000 for the purpose of carrying on a general machine and foundry business. The officers are: D. I. Miller, president; John Donk Jr., vice president; E. G. Moss, secretary.

The Southern Foundry & Machine Co., Birmingham, Ala., has been incorporated with a capital stock of $25,000. The incorporators are: John Daniel, John Armstead, C. H. Ungermann and W. J. Rushton.

James B. Rountree and Robert E. Cook, both of whom have been connected with the American Locomotive Works at Richmond, Va., have organized the American Foundry Co., Manchester, Va.

The Acme Foundry Co. has been incorporated at Louisville, Ky., with a capital of $10,000. The incorporators are: Chas. H. Shield, J. W. Stine Jr. and J. Robinson Bridgeford.

The Ensley Machine & Foundry Co., Ensley, Ala., has been incorporated to manufacture castings. The capital stock is $2,500, and the incorporators are: W. T. Palmer, Evan J. Owen and Arthur H. Moore.

The Licking Rolling Mill, the Droege & Sons' Coal Co., and the Droege & Sons' Foundry Co., all of Covington, Ky., have been reorganized and will hereafter be known as the I. Droege & Sons' Iron, Foundry & Coal Co. The capital stock of the company is $1,000,000.

The Roanoke Foundry & Machine Co., Roanoke, Va., has been incorporated to operate a foundry and machine shop. The capital stock is $30,000, and the incorporators are: A. J. Kennard, J. E. Reichhardt, J. W. Winston, H. E. Oebnschain, A. D. Pettyjohn, J. L. Richey and others.

The Bessemer Steel Casting Co., Bessemer, Ala., has been organized with a capital of $150,000 and will manufacture basic open-hearth steel castings by the Hawkins-Key process. The plant will have a capacity of 75 to 100 tons a day.

The Polson Iron Works, of Toronto, Ont., provided they can buy from the city the piece of land west of their present works, will begin the manufacture of steel castings, for which they are now dependent on American manufacturers.

The Rogers Mfg. Co., Ltd., Toronto, Ont., has been incorporated with a capital of $200,000 to engage in foundry and machine work. The provisional directors are: Albert F. Reitz and Albert J. Stanford, of Kansas City, Kan., and Loftus E. Dancey.

The Smiths Falls (Ont.) Malleable Castings Co. has purchased the Rideau Malleable & Foundry Co., of the same town, and the two companies have been consolidated.

The Indiana Brass & Bronze Co., Marion, Ind., has been incorporated with a capital stock of $20,000, and has organized with the election of the following officers: George R Stewart, president; John Goodnow, vice president and superintendent; Fred Stepherson, treasurer, and John O. Wilson, secretary. The old Transit power house in Marion has been remodeled for the foundry.

The Independent Foundry Co., Kalamazoo, Mich., recently organized, has leased a building for the manufacture of iron castings. Harry Scofield and James B. Arterburn are at the head of the company.

The Manitowoc Bronze & Brass Co., Manitowoc, Wis., has been incorporated with a capital stock of $25,000. The incorporators are Wm. Hess, A. L. Nash and W. L. Morris. A factory

building has been leased and equipment for the foundry ordered. All kinds of brass and bronze castings will be made. W. L. Morris will have charge of the plant.

The machine shop and foundry of the Sanilac Center Mfg. Co., Sandusky, Mich., have been sold to Wm. Reel, who will operate the same as a repair shop.

The Greenville Machine Works, the property of R. M. McDonald, was recently bought out by the Mountain City Foundry & Machine Works, Greenville, S. C.

The Salem Foundry & Machine Co., Salem, Va., has been incorporated by J. E. Shank and W. S. Shank, of Salem, Va., and H. D. Shank, of Cedar Bluff.

The Sheffield Foundry Co., Kansas City, Mo., has been incorporated with a capital of $20,000, by John W. Kipp, John W. Barlow, and Henry S. Bachelor.

The A. Kilpatrick Sons Foundry Co., of St. Louis, Mo., has increased its capital stock from $10,000 to $50,000.

The Tonapah Foundry & Machine Co., Tonapah, Nev., has been organized with a capital of $100,000, and the following officers have been elected: R. P. Dunlap, president; Mark B. Kerr, first vice president; Alonzo Tripp, second vice president; Herbert A. Tripp, secretary. F. A. Taylor will be general manager. The company will construct a foundry and machine shop and manufacture iron, brass and bronze castings.

The Trader-Lang Brass Mfg. Co., Kansas City, Mo., has been incorporated to manufacture lighting fixtures and brass novelties. The capital stock is $30,000 and Herman F. Lang and others are interested.

A. L. Taylor, of San Francisco, Cal., has succeeded to the business of Fair, Taylor & Co., and Seymour R. Church, deceased, both dealers in foundry supplies. They were burned out in the great fire and headquarters were established in Oakland, but Mr. Taylor has now opened an office at 9 California street, San Francisco, and is ready to supply the needs of the Pacific coast foundrymen.

The Canada Stove Co., Ltd., has been incorporated with head office at Ottawa and a capital of $150,000, the provisional directors being Fergus J. Travers, Geo. Tomlinson, Geo. A. Mothersill, Frederick R. Yule and John I. McCracken.

Patrick J. Powers, Michael Lannon, Thos. McBrearty, Maxime Viau and Lorenzo Dalpe, have been incorporated as the P. J. Powers Co., Ltd., Ottawa, to do a foundry and machine shop business with a capital of $45,000.

The Allis-Chalmers-Bullock, Ltd., of Montreal, will increase its capital stock from $1,200,000 to $2,500,000 on account of its rapidly increasing business.

The Kaysing Iron & Foundry Co., St. Louis, Mo., has been incorporated with a capital of $10,000 by Wm. G. Kaysing, C. E. Collett, Edward De Vries and others.

The controlling interest of the Commonwealth Steel Co., formerly held by the American Steel Foundries, has been purchased by Clarence H. Howard, of St. Louis, Mo.

Butterworth & Co., Ltd., Ottawa, Ont., founders, fitters, etc., have been organized with a capital of $100,000. Enoch B. Butterworth, Charles A. Butterworth and Alfred F. Butterworth are provisional directors.

The British Canadian Engineering Co., Ltd., Toronto, Ont., has been organized with a capital of $250,000 to carry on the business of mechanical and electrical engineers and iron founders. The provisional directors are: John J. Sutcliffe, Ernest S. Sutcliffe and Rutherford Williamson.

The Allyne Brass Foundry Co., operating plants in Cleveland and Detroit, has taken over the plant of the Liberty Brass Foundry, of Buffalo, N. Y., and will conduct the business under the name of the Allyne Brass Foundry of New York. The directors are E. E. Allyne, George C. Miller and R. A. White.

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The Imperial Caesar.

You remember him? He became a little too confident and so reached an untimely end.

Constant care is the sign board on the road to success.

The cost of your labor is your greatest cost. In lessening that cost you increase the profit.

Use STEVENS' CARBON BLACKING as a wet blacking or as a core wash, and you reduce the cost of your cleaning or "chipping" department.

That is already proven and I will mail you the proof over signature of twenty representative foundrymen.

Try a barrel---at my risk.

I manufacture an extensive line of Foundry Facings for good service on any mold for any casting. Goods of quality only.

Everything for a Foundry.

FREDERIC B. STEVENS,

Cor. Larned & Third Sts. DETROIT, MICH.

CLASSIFIED

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Advertisers' names are inserted under this heading at the rate of four classifications to each page advertisement carried regularly.

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Norton Company, Worcester, Mass.

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Curtis & Co. Mfg. Co., St. Louis.
Independent Pneumatic Tool Co., Chicago.
Norwalk Iron Works Co., So. Norwalk, Conn.

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New Era Mfg. Co., Kalamazoo, Mich.
Phosphor Bronze Smelting Co., Ltd., Philadelphia.

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Analysis—Chemical:
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Connersville Blower Co., Connersville, Ind.
Cornell Co., J. B. & J. M., New York.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson Co., J. W., Philadelphia.
Piqua Blower Co., Piqua, O.
Roots Company, P. H. & F. M., Connersville, Ind.
Sturtevant, B. F. Co., Hyde Park, Mass.

Blowers—Positive Pressure:
Connersville Blower Co., Connersville, Ind.
Piqua Blower Co., Piqua, O.
Roots Company, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Hyde Park, Mass.
Wilbraham-Green Blower Co., Philadelphia.

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Brushes:
Osborn Mfg. Co., Cleveland.

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Burners (Oil):
Monarch Engineering & Mfg. Co., Baltimore.

Carbonese:
Midvale Mining & Mfg. Co., E. St. Louis, Ill.

Castings (Steel):
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Cement (Furnace):
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Gautier & Co., J. H., Jersey City.

Cement (Metallic):
Clark Cast Steel Cement Co., Shelton, Conn.
Shelton Metallic Filler Co., Derby, Conn.
Shanafelt Mfg. Co., Canton, O.
Smooth-On Mfg. Co., Jersey City.

Chaplets:
Burdick & Son, Albany.
Lindsay & Co., W. W., Philadelphia.
Shanafelt Mfg. Co., Canton, O.

Coke:
Rogers, Brown & Co., Cincinnati.
Surplus Coke Co., New York.

Controllers (Electric):
Electric Controller & Supply Co., Cleveland.

Cores:
Brown Specialty Machry. Co., Chicago.

Core Binders:
Mills Oil Co., C. E., Syracuse.
National Jeloluse Co., New York.
Robeson Process Co., Camden, N. J.
Sterling Oil Co., Emlenton, Pa.
Young, Frank L., & Kimball, Boston.

Core Compounds:
Young, Frank L. & Kimball, Boston.

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Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Jones & Atwood, Stourbridge, Eng.
Kent Mfg. Co., Kent, O.

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Brown Specialty-Machinery Co., Chicago.

Core Ovens:
Atlas Car & Mfg. Co., Cleveland.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Millett Core Oven Co., Brightwood, Mass.
Paxson Co., J. W., Philadelphia.
Pangborn Co., Thos. W., New York.
Smith Foundry Supply Co., J. D., Cleveland.

Core Oven Recording Thermometer:
Bristol Co., Waterbury.

Cost Keeping Systems.
Gunn, Richards & Co., New York.
Library Bureau, Systematizing Dept., Boston.
Loughry, James C., Elyria, O.

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The Cost of It

The expense of a modern system of cost-keeping need be no greater than a crude, antiquated and inefficient way of keeping accounts.

Such a system is accurate, quick and in ample detail, and it gives the detailed costs of every part of the work while the business is fresh—when it is most valuable as a basis of comparison.

We have studied cost-keeping very carefully and have installed systems which meet these requirements in many well-known foundries.

Will you accord us an interview?

GUNN, RICHARDS & COMPANY

Production Engineers and Public Accountants.....

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50 CONGRESS STREET, BOSTON

224 ST. JAMES STREET, MONTREAL

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Case Mfg. Co., Columbus, O.
Curtis & Co. Mfg. Co., St. Louis, Ill.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia.
Niles-Bement Pond Co., New York.
Northern Engrng. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Ridgway & Son, Craig, Coatesville, Pa.
Sellers & Co., William, Inc., Philadelphia.
Whiting Foundry & Equipment Co., Harvey, Ill.

Crucibles:
Dixon Crucible Co., Jos., Jersey City.
Taylor, A. L., San Francisco.
Gautier & Co., J. H., Jersey City.
McCullough-Dalzell Crucible Co., Pittsburg.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson Co., J. W., Philadelphia.
Ross-Tacony Crucible Co., Philadelphia.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, Robt. J., Inc., Philadelphia.

Cupolas:
Byram & Co., Detroit.
Gilmour, J., New York.
McCormick Co., J. S., Pittsburg.
Northern Engnrng Works, Detroit.
Paxson Co., J. W., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupola Linings:
McCormick Co., J. S., Pittsburg.
Paxson Co., J. W., Philadelphia.

Drills:
Chicago Pneumatic Tool Co., Chicago.
Independent Pneumatic Tool Co., Chicago.

Electric Generating Sets.
Sturtevant, B. F. Co., Hyde Park, Mass.

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Curtis & Co. Mfg. Co., St. Louis.
Ridgway & Son, Craig, Coatesville, Pa.

Engines (Steam):
American Blower Co., Detroit.
Sturtevant Co., B. F., Hyde Park, Mass.

Engineers (Foundry, Mech., Elec., &c.):
Dodge & Day, Philadelphia.
Hooper, Geo. K., New York City.
Lindsay & Co., W. W., Philadelphia.

Exhausters (Gas):
Wilbraham-Green Blower Co., Philadelphia.

Facings:
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Doggett, Stanley, New York.
Hill & Griffith Co., Cincinnati.
R. MacKellar's Sons Co., Peekskill, N. Y.
McCormick Co., J. S., Pittsburg.
Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.
Pettinos Bros., Bethlehem, Pa.
Smith Foundry Supply Co., J. D., Cleveland.
Stephens & Co., Kidwelly, Eng.
Stevens, F. B., Detroit.
Western Foundry Supply Co., E. St. Louis, Ill.

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Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

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Fire Brick:
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Harbison & Walker, Pittsburg.
Maurer & Son, Henry, New York.
Paxson Co., J. W., Philadelphia.

Fire Sand:
Carborundum Co., Niagara Falls, N. Y.

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Barnett Fdy. Co., Oscar, Newark.
Brass Founders' Supply Co., Newark.
Middleditch, Benj., Detroit.

Flasks (Snap):
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Diamond Clamp & Flask Co., Richmond, Ind.
Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.

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Basic Chemical Co., Evansville, Ind.

Foundry Engineering:
Lane, H. M., Cleveland.

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Obermayer Co., S., Cincinnati.
Pangborn Co., Thos. W., New York.
Sly, W. W. Mfg. Co., Cleveland.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.
Wiener Co., Ernest, New York.

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Hill & Griffith Co., Cincinnati.
McCormick Co., J. S., Pittsburg.
Obermayer Co., S., Cincinnati.
Osborn Mfg. Co., Cleveland.
Pangborn Co., Thos. W., New York.
Paxson Co., J. W., Philadelphia.
Shanafelt Mfg. Co., Canton, O.
Smith Foundry Supply Co., J. D., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.

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The direct benefits

From the President of an Iron Works of national reputation:

"I find comfort in the feeling that this thing is figured to a nicety for me each month. Our average cost of castings last month was .0242½, which resulted in an increase in the price per pound to a customer, which contract we made some time ago with one of the railroads with whom we do considerable business; our monthly account showing that we were losing money by continuing along the same price. This is where the benefits of your labor come in."

Does your cost information come to you at the time when you can use it to the best advantage?

Is it exact enough to base prompt and definite action upon?

May we lay before you the distinctive features of our service?

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316 Broadway, New York

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Paxson Co., J. W., Philadelphia.
Rockwell Engineering Co., New York.

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United States Graphite Co., Philadelphia.

Grinding Machinery:
Adams Co., Dubuque, Ia.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Norton Co., Worcester.
Ransom Mfg. Co., Oshkosh, Wis.

Grinding Wheels:
Norton Co., Worcester.

Hammers:
Independent Pneumatic Tool Co., Chicago.

Hammers (Pneumatic):
Chicago Pneumatic Tool Co., Chicago.

Hammers (Pneumatic Chipping):
Ingersoll-Rand Co., New York.

Heating & Ventilating Apparatus:
American Blower Co., Detroit.
Sturtevant Co., B. F., Hyde Park, Mass.

Hoists:
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General Pneumatic Tool Co., Montour Falls, N. Y.
Harrington Son & Co., Edwin, Philadelphia.
Niles-Bement-Pond Co., New York.
Northern Engrg. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Sellers & Co., Inc., William, Philadelphia.
Sturtevant, B. F. Co., Hyde Park, Mass.
Whiting Fdy. Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York.

Hoists (Pneumatic):
Chicago Pneumatic Tool Co., Chicago.
Ridgway & Son, Craig, Coatesville, Pa.

Hydrofluoric Acid:
General Chemical Co., Philadelphia.

Industrial Ry. Equipment:
Atlas Car & Mfg. Co., Cleveland.
Wiener Co., Ernest, New York.
Wonham & Magor, New York.

Iron Ore:
Rogers, Brown & Co., Cincinnati.

Ladles:
Northern Engrg. Works, Detroit.
Smith, J. D., Foundry Supply Co., Cleveland.

Magnets (Lifting):
Electric Controller & Supply Co., Cleveland.

Malleable Iron Melting Furnace:
Buffalo Furnace Works, Buffalo.

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Arcade Manufacturing Co., Freeport, Ill.
Berkshire Mfg. Co., Cleveland.
Bonvillian, Ph. & E. Ronceray, Paris, France.
Herman Pneumatic Machine Co., Zelienople, Pa.
Manning, Maxwell & Moore, New York.
Maywood Foundry & Machine Co., New York.
Mitchell-Parks Mfg. Co., St. Louis.
Mumford Co., E. H., Philadelphia.
Paxson Co., J. W., Philadelphia.
Pridmore, Henry E., Chicago.
Rathbone, John A., Detroit.
Smith, J. D., Foundry Supply Co., Cleveland.
Tabor Mfg. Co., Philadelphia.
Turner Machine Co., Philadelphia.

Pattern Letters:
Shanafelt Mfg. Co., Canton, O.

Packing (Rubber Sheet):
Smooth-On Mfg. Co., Jersey City.

Parting Compounds:
Foundry Specialty Co., Cincinnati.
Partamol Co., New York.

Parting Materials:
Doggett, Stanley, New York.

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Pattern Shop Equipment:
Fox Machine Co., Grand Rapids, Mich.

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New Era Mfg. Co., Kalamazoo.

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Baird & West, Detroit.
Bartlett & Co., N. S., Boston.
Cherry Valley Iron Co., Pittsburg.
Columbus Iron & Steel Co., Columbus.
Dalton, Nash & Co., New York.
De Camp Bros. & Yule, St. Louis.
Dimmick & Co., J. K., Buffalo.
Domhoff & Joyce Co., Cincinnati.
Elliott, Debevoise & Anderson, New York.
Field Sales Agency, Robert, Cincinnati.
Goodrich & Co., F. A., Detroit.
Hillman & Son, J. H., Pittsburg.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., Philadelphia.
Pickands, Brown & Co., Chicago.
Pickands, Mather & Co., Cleveland.
Pilling & Crane, Philadelphia.
Rogers, Brown & Co., Cincinnati.
Shepard, Chas. G., Buffalo.
Stevens, F. B., Detroit.
Thomas Furnace Co., Milwaukee.
Walter-Wallingford & Co., Cincinnati & Pittsburg.

Plumbago:
Dixon Crucible Co., Jos., Jersey City.
Gautier & Co., J. H., Jersey City.
Hill & Griffith Co., Cincinnati.
McCullough-Dalzell Crucible Co., Pittsburg.
Obermayer Co., S., Cincinnati.

Continued on page 134.

NORTON GRINDING WHEELS

MADE OF

ALUNDUM

are the most efficient and economical grinding wheels. ALUNDUM is used exclusively in the manufacture of Norton Wheels and is not only the sharpest abrasive, but the most uniform. There's an advantage in the latter quality that is worth your best attention—uniformity in grinding wheels and ability to duplicate a certain grade is one of our strong points.

We make ALUNDUM into grinding wheels of all sizes, shapes and grits that modern practice calls for.

NORTON COMPANY

WORCESTER, MASSACHUSETTS

NIAGARA FALLS **NEW YORK** **CHICAGO**

4

ESTABLISHED 1875.

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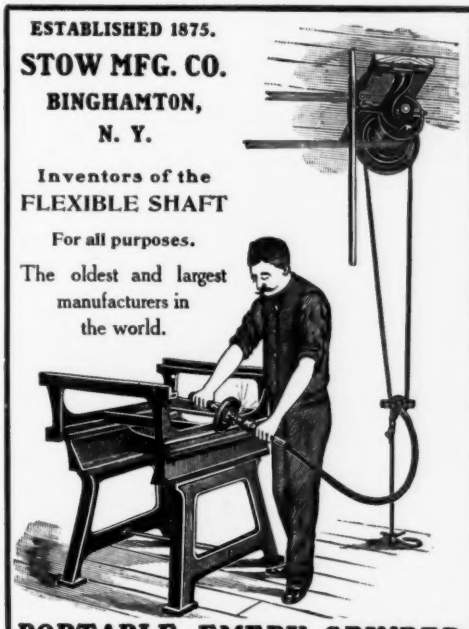
BINGHAMTON, N. Y.

Inventors of the FLEXIBLE SHAFT

For all purposes.

The oldest and largest manufacturers in the world.



PORTABLE EMERY GRINDER

Take the tool to the work and save heavy handling.

Write us for Catalogue and Prices.

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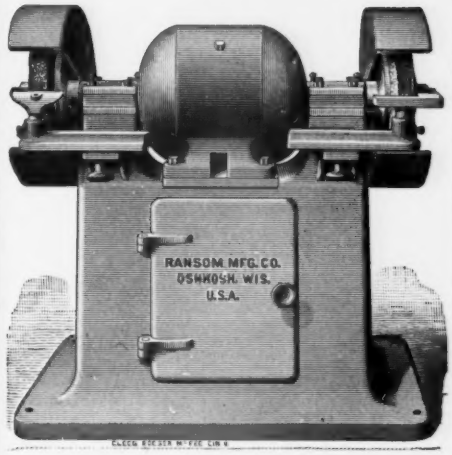

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RANSOM MFG. CO.

OSHKOSH - - - WIS.

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Pettinos Bros., Bethlehem, Pa.
Ross-Tacony Crucible Co., Philadelphia.
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Stevens, F. B., Detroit.
United States Graphite Co., Philadelphia.

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Stevens, F. B., Detroit.

Riddles:

Adams Co., Dubuque, Ia.

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Newport Sand Bank Co., Newport, Ky.
Paxson Co., J. W., Philadelphia.
Pangborn Co., Thos. W., New York.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.

Sand Blast Machinery:

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Pangborn Co., Thos. W., New York.
Paxson Co., J. W., Philadelphia.
Tilghman-Brooksbank Sand Blast Co., Philadelphia.

Sand Mixing Machinery:

Falls Rivet & Machine Co., Cuyahoga Falls, O.
Mumford, E. H., Philadelphia.
Pangborn Co., Thos. W., New York.
Sellers & Co., Inc., William, Philadelphia.
Stockham Homogeneous Mixer Mfg. Co., Piqua, O.
Standard Sand & Machine Co., Cleveland.

Sand Sifters:

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Deane Steam Pump Co., Holyoke, Mass.
Hanna Engrg. Works, Chicago.
Herman Pneumatic Machine Co., Zelienople, Pa.
Standard Sand & Machine Co., Cleveland.

Saws (Cold Cutting):

Tabor Mfg. Co., Philadelphia.

Seacoal:

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Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.

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Elm City Engineering Co., New Haven.
Pangborn Co., Thos. W., New York.

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Sprue Cutters:

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Shuster Co., F. B., New Haven.
Middleditch, Benj., Detroit.

Stoppers:

McCullough-Dalzell Crucible Co., Pittsburg
Ross-Tacony Crucible Co., Philadelphia.
Taylor, Robert J., Inc., Philadelphia.

Stove Trimmings:

Burdick & Son, Albany, N. Y.

Testing Machines:

Keep, W. J., Detroit.

Thermit Process:

Goldschmidt Thermit Co., New York.

Tools (Molders'):

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Obermayer Co., S., Cincinnati.
Paxson Co., J. W., Philadelphia.
Smith Foundry Supply Co., J. D., Cleveland.

Tools (Pneumatic):

Chicago Pneumatic Tool Co., Chicago.
Independent Pnuematic Tool Co., Chicago.

Tramrail Systems:

Randall & Co., R. T., Philadelphia.

Tumbling Mills:

Adams Co., Dubuque, Ia.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Gilmour, J., New York.
Sly, W. W. Mfg. Co., Cleveland.
Smith, J. D., Foundry Supply Co., Cleveland.

Twyers, Cupola:

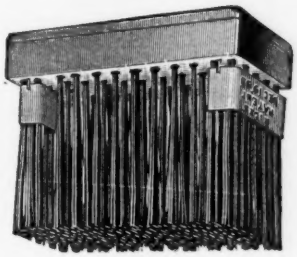
Watt Cupola Twyer Co. Barnesville, Ohio.

Wire Straighteners:

Shuster Co., F. B., New Haven.
Blake Mfg. Co., Geo. F., New York City.

Every House

with a familiar sound to its name—every well-known firm catering to the foundry trade, carries an ad in The Foundry. Look them over.



Rice's Patent Bridled Casting Brush

If you have not used this brush, order a sample lot to be forwarded with next shipment.

Casting Brushes go to pieces because the end wires break off. Unhindered vibration causes this breaking. Our Patent Hinged Bridle prevents this vibration and the consequent breaking, making the brush last twice as long as the ordinary casting brush. The bridle is hinged to move freely so that the brush retains its flexibility.

NOTE.—We have recently acquired exclusive rights to the patents on this brush and are now the SOLE MANUFACTURERS.

THE OSBORN MANUFACTURING CO., *Cleveland.*

The "Everlasting" Triplex Block

A 216 MILE Chain Block Lift

Twenty YALE & TOWNE TRIPLEX BLOCKS have been in use for about 6 years in a rubber works. Each block makes lifts averaging daily 600 ft. This is at the rate of 3 miles per month, 36 miles per year or 216 miles in 6 years. The blocks are still in first-class shape.

Can you use hoists like these?

YALE & TOWNE MFG. CO.

9-15 Murray St., New York.

THE INJECTOR SANDBLAST APPARATUS

For cleaning thoroughly Steel, Iron and Brass Castings with minimum amount of compressed air and maximum speed.

C. DRUCKLIEB,

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FIRST-CLASS WOOD WORKING PLANT, new modern machinery, located in town of about 2,000 inhabitants. Will sell outright or exchange for business proposition. E-ll, care Lord & Thomas, Chicago, Ill.

CONTROLLING INTEREST IN JOBBING FOUNDRY, Detroit. Fine paying business. Good reasons for selling. Address Box 871 THE FOUNDRY, Cleveland, Ohio.

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JOBBING FOUNDRY INCLUDING FULL EQUIPMENT and at present in operation with established business. Paying well. Positively good reasons for selling. Reliable Foundry & Machine Co., Quincy, Ill.

SMALL FOUNDRY LOCATED IN CENTRAL NEW YORK, 3 miles from fast growing city of about 10,000 inhabitants, on one of the leading Railways of the state. Good established business, employing three to four men steady. Only foundry within 40 miles. Easy terms. Address Box 843, THE FOUNDRY, Cleveland, Ohio.

A COMPLETELY EQUIPPED BRASS FOUNDRY and Machine Shop for the manufacture of Plumbers' goods. A splendid line of patterns and new machinery and tools. Trade well established. Situated where there are no labor troubles and within 100 miles from Chicago. Address Box 814, THE FOUNDRY, Cleveland, Ohio.

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FOUNDRY FOR RENT OR LEASE. In running order in St. Louis, 5,000 feet floor space. Rent $25.00 per month. Address Box 855, THE FOUNDRY, Cleveland, Ohio.

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WANTED TO PURCHASE malleable iron foundry plant. Must be well equipped and running concern. Address Box 872, THE FOUNDRY, Cleveland, Ohio.

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CAST IRON TOY PATTERNS. Complete, up-to-date line. All gated and in excellent condition. Also several thousand dollars' worth of orders and sales included. Increase other lines compels us to discontinue toys. Address Box 866, THE FOUNDRY, Cleveland, Ohio.

COMPLETE SET OF ORNAMENTAL VASES, AQUARIUM patterns both plain and with fountain. The patterns are in good condition and can be shipped immediately. Abendroth Brothers, Port Chester, N. Y.

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TWO SECOND-HAND CUPOLAS IN FIRST-CLASS condition. Shells 72"-82" in diameter and about 40 feet high. Box 800, THE FOUNDRY, Cleveland, Ohio.

ONE COLLIAU CUPOLA, No. 24, 42 inches diameter outside, and one No. 6 Buffalo Forge Pressure Blower, both in good condition. Reason for selling, have enlarged plant. Address Empire Foundry Co., Syracuse, N. Y.

FOR SALE, MISCELLANEOUS

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or Agents Penna. Salt Mfg. Co., Pittsburg, Pa.

THE FOLLOWING FOUNDRY MACHINERY all in good repair:
One No. 4 Whiting Foundry Cupola.
One 45" Buffalo Cupola Blower.
One 6-ton Jib Crane.
One 60" Adams Molding Machine.
One Hammer Core Machine for 16 sizes
William R. Perrin & Co., Loomis & 46th streets, Chicago, Ill.

A 15-TON SWINGING CRANE WITH A 20-ft. reach with 2 large ladles and all necessary chains suitable for a jobbing foundry. Also 125 jobbing flasks, suitable for a small jobbing foundry. All in first-class condition. Address The Wm. Resor & Co., Cincinnati, Ohio.

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2 No. 7 Baker Blowers with Engines.
1 No. 7 Green Blower and Engine.
1 each—No. 3, 4 and 5 Baker Blowers, belt-driven.
1 each—No. 6 and 7 Sturtevant Blower, motor-driven.
1 No. 5 Sturtevant Blower, belt-driven.
1 each—1½, 2, 7, 12 and 25-ton Geared Ladles.
1 62" Whiting Cupola.
2 Paxson Colliau Cupolas, 72".
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One second-hand 7-ton Foundry Crane, made by Craig, Ridgway & Co.
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One second-hand Cupola, 48" diameter, complete.
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All the above machinery is in strictly first class condition; but we are increasing our capacity, and will sell this machinery at a bargain. The Casey-Hedges Co., Chattanooga, Tenn.

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1 second-hand No. 7 Sturtevant Blower, complete $25.00
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For further particulars apply to the Ashtabula Foundry Co., Ashtabula, O.

KEEP UP-TO-DATE. Learn the newest things in your business. We can furnish you with all the latest and best books on foundry iron and steel subjects. Write for catalog. The Penton Publishing Co., Book Department, Cleveland, Ohio.

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FOUNDRY EQUIPMENT WANTED.—Cupola (6 to 10 tons), and equipment for small Stove plate foundry. Location near Chicago. Address Box 856, THE FOUNDRY, Cleveland, Ohio.

WANTED.—42″ Schwartz furnace. Give description and price. Address Box 826, THE FOUNDRY, Cleveland, O.

A NEW YORK CONCERN DESIRES THE SALES AGENCY of Machinery or Specialties for foundry, mill or contractors' use. Success in selling insured by up-to-date methods. Address Box 877 THE FOUNDRY, Cleveland, O.

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PARTNER WANTED WITH SOME CAPITAL for a foundry and machine shop in a good Kentucky town of 10,000 people. Must be a good all-round mechanic and able to act as foreman in the foundry. To the right party who is tired of working for others, and wants to do something for himself, good inducement will be given. Address Box 837, THE FOUNDRY, Cleveland, Ohio.

$5,000 to $10,000 to invest with services in malleable foundry by practical man now superintendent in modern western shop. Have designed, constructed and equipped all departments. Nothing but a first-class proposition considered. Address Box 754, THE FOUNDRY, Cleveland, Ohio.

AN OPPORTUNITY FOR A FOUNDRYMAN WITH SOME CAPITAL is offered by the advertisers who have recently come into possession of a large foundry plant located near their factory in Ohio and whose present business requires their exclusive attention, preventing them from operating it. They are willing to lease the foundry plant on favorable terms to some foundryman understanding the business, and with sufficient capital to operate it, with the understanding that they will give the lessor all the foundry business in connection with their product, which requires considerable of that line of work. The owners can also furnish the power if desired. The location is a most favorable one for this line. The foundry has splendid shipping facilities, including switches from two roads on the property. For further information, address Box 863, THE FOUNDRY, Cleveland, Ohio.

BUSINESS OPPORTUNITY. Would purchase, with cash, active control of good manufacturing, established business in the East. Must be sound and staple requiring investment of $20,000 or over. Iron Founders take notice. Principals only. Address Box 876, THE FOUNDRY, Cleveland, Ohio.

ASST. SUPERINTENDENT WANTED

ASSISTANT SUPERINTENDENT FOR AN IRON FOUNDRY and Machine Shop employing about 350 men. Must have good executive ability and be familiar with methods that produce results. State age, references, synopsis of experience and salary expected. Box 795, THE FOUNDRY, Cleveland, Ohio.

SALESMAN WANTED

SALESMAN FOR JOBBING BRASS FOUNDRY in the East, on small castings, a hustler who knows the trade and is capable of making prices. One who could handle it as a side line preferred. Address Box 867, THE FOUNDRY, Cleveland, Ohio.

CORE ROOM HELP WANTED

FOREMAN WANTED.—For core room employing 35 men. Man who is competent to handle pump cores. Advise age and particulars. Address Box 831, THE FOUNDRY, Cleveland, O.

FIRST-CLASS CORE MAKERS WANTED.—Wages $3.50 per day, nine hours. Columbia Engineering Works, Portland, Ore.

FOREMAN FOR CORE ROOM employing 12 men on agricultural implements. Must be strictly up-to-date in making different core mixtures and establishing piece-work prices. Non-union. State age, experience, references and wages expected. Address Box 859, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN WANTED

FIRST-CLASS FOUNDRYMAN WANTED for steel and iron casting to act as foreman at big iron and steel works in Sweden. Address Box 860, THE FOUNDRY, Cleveland, Ohio.

FOREMAN FOR MALLEABLE FOUNDRY doing a general jobbing business in the middle West, employing about 125 molders. State age and where formerly employed. Address Box 850, THE FOUNDRY, Cleveland, Ohio.

FOREMAN FOR FOUNDRY ON PUGET SOUND. Young man preferred. Must understand handling of men and ability to show results. Saw mill and general machinery. Twenty to thirty molders employed. No labor troubles. Good opening for proper man. Address Box 848, THE FOUNDRY, Cleveland, Ohio.

FOREMAN OF STRICTLY FIRST-CLASS ABILITY for general foundry making heavy and light gray iron castings. Address Box 851, THE FOUNDRY, Cleveland, Ohio.

FOREMAN WANTED TO TAKE CHARGE OF JOBBING FOUNDRY employing about thirty-five molders. Must be up-to-date in handling men and placing work to advantage. Union shop. State wages, age and experience. Address Box 852, THE FOUNDRY, Cleveland, Ohio.

A SOBER, INDUSTRIOUS WORKING FOREMAN for small foundry. Small Mining Camp, Central California. Good wages—no labor troubles. Steady position for right man. State age, experience, references. Box 854, THE FOUNDRY, Cleveland.

FOREMAN FOR GROWING FOUNDRY now employing about 25 men doing a good class of medium and heavy work. Must be energetic and progressive and up on cupola practice with a knowledge of foundry chemistry. Applicants should give age, experience and salary desired. Address Box 846, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN TO TAKE CHARGE OF FOUNDRY employing about 20 molders. Must be able to produce results and come well recommended. State age, experience and give references, and salary desired. Address Box 868, THE FOUNDRY, Cleveland.

FOREMAN FOR BRASS FOUNDRY IN CHICAGO employing about fifteen molders, wanted. Up-to-date man, familiar with machines and modern methods. Must be non-union. Address Box 879, THE FOUNDRY, Cleveland, Ohio.

PATTERNSHOP HELP WANTED

PATTERN MAKER WORKING FOREMAN, small shop, eastern city. Chance for right man to grow. State age, experience and pay expected. Address Box 865, THE FOUNDRY, Cleveland, Ohio.

EXPERT STOVE PATTERN FITTER WANTED, thoroughly competent in all branches of iron, stove and range pattern fitting,—to take charge of shop. Must be sober. Married man preferred. Steady work, good salary. State age, experience, salary and references. James Graham Mfg. Co., 27 Minna St., San Francisco, Cal.

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STEADY, EXPERIENCED STEEL MOLDERS WANTED, preferably married men. Wages $3.75 per day, nine hours. Columbia Engineering Works, Portland, Ore.

ONE OR TWO ALL-AROUND MACHINERY MOLDERS WANTED in the far West. Good inducements for steady, reliable men who can come well recommended. Open shop, no trouble. Address, stating age, experience, etc., Box 857, THE FOUNDRY, Cleveland, Ohio.

FOUR FLOOR AND TWO BENCH MOLDERS WANTED in the Central West. Open shop, big wages and steady work for workmen who are reliable men. Address Box 751, THE FOUNDRY, Cleveland,

CONTINUED ON PAGE 138

HELP WANTED, MISCELLANEOUS

A SUPERINTENDENT WANTED by one of the largest Steel Foundries in the country. Only men of experience need apply. Give experiences and full particulars. Address Box 883, THE FOUNDRY, Cleveland, Ohio.

CAPABLE CUPOLA TENDER WANTED, preferably one who has had experience in converter steel foundry. Columbia Engineering Works, Portland, Ore.

A RIGGER-UP IN A LARGE LIGHT GRAY IRON FOUNDRY, wanted, practical workman with knowledge of stripping plate and rock-over molding machines. Address, stating age, wages required and particulars as to class of molding machine work experienced in. Box 864, THE FOUNDRY, Cleveland, Ohio.

AN OPEN SHOP FOUNDRY IN EASTERN PENNSYLVANIA, making gray iron castings for Steam Specialties, desires to engage a man having experience with different kinds of molding machines, and who is competent to attend to the making or altering of patterns for the machines, and to instruct men in operating same. Address with full particulars as to experience and references. Box 873, THE FOUNDRY, Cleveland, Ohio.

CLEANING ROOM FOREMAN FOR FOUNDRY. State reference and wages expected. Address The L. Schreiber & Sons Co., Cincinnati, Ohio.

COMPETENT FOREMEN OF BRASS FINISHING ROOM wanted for concerns in Pennsylvania and Massachusetts; must be experienced, aggressive men, familiar with all up-to-date methods; salaries, $1,200-$1,800. Hapgoods, 305 Broadway, New York.

WARE BOSS WANTED to take charge of plate room of large stove shop. Address Box 834, THE FOUNDRY, Cleveland, Ohio.

FOREMANSHIP WANTED

FOREMAN ACCUSTOMED TO GREEN AND DRY SAND and general jobbing work desires position. Up-to-date on molding machines and cupola practice. Address Box 853, THE FOUNDRY, Cleveland, Ohio.

POSITION AS FOREMAN wanted by first-class foundryman with good executive ability on light or heavy work. Address Box 810, THE FOUNDRY, Cleveland, Ohio.

FOREMAN DESIRES POSITION in a light, gray iron shop. Twenty-two years' experience. Can furnish references. Address Box 861, THE FOUNDRY, Cleveland, Ohio.

POSITION AS CORE FOREMAN wanted by young man with good executive ability. Strictly sober and up-to-date in modern core methods. Large work preferred. Address Box 874, THE FOUNDRY, Cleveland, Ohio.

POSITION AS FOREMAN PATTERN MAKER wanted. Malleable, Sanitary or Machine. Eighteen years' experience. Capable of handling men. Can give reference. Address Box 880, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN OPEN FOR ENGAGEMENT. A man that is competent of taking full charge of a foundry in all its details. Fifteen years' experience at molding in gray iron. Six years a foreman and superintendent. Full particulars and references on request. Address Box 878, THE FOUNDRY, Cleveland, Ohio.

SUPERINTENDENTS WANT POSITIONS

POSITION AS SUPERINTENDENT OR GENERAL FOREMAN wanted by a practical foundryman. 22 years' experience, up-to-date on the latest methods. Understand molding machines thoroughly. Best of reference. Address Box 869, THE FOUNDRY, Cleveland, Ohio.

AN EXPERIENCED AND THOROUGHLY PRACTICAL malleable iron foundry superintendent solicits correspondence. References. Care Box 849, THE FOUNDRY, Cleveland, Ohio.

POSITION AS SUPERINTENDENT IN FOUNDRY. Competent and of good executive ability. Well up in small and medium sized work, annealed and soft castings and general tool and engine work. Good mixer of metals for all grades of work. Thoroughly commercial, careful and well able to manage a plant profitably. Address Box 759, THE FOUNDRY, Cleveland, Ohio.

SITUATION WANTED BY MAN AGED 20, as assistant to superintendent or a responsible position in office of a foundry. Two years' experience as bookkeeper and stenographer. Have had practical experience in foundry working as molder, cupola assistant and coremaker. Address Box 862, THE FOUNDRY, Cleveland, Ohio.

POSITION AS FOUNDRY MANAGER OR SUPERINTENDENT wanted by a young man with 15 years' experience on extremely heavy loam and light green sand castings. Thoroughly practical on all types of molding machines and up-to-date on foundry appliances; also familiar with the very best methods of metal pattern work. Have mechanical education and have traveled considerably. Will not consider a small shop or cheap job. Address Box 875, THE FOUNDRY, Cleveland, Ohio.

POSITION AS ASSISTANT SUPERINTENDENT or foundry chemist wanted. Technical graduate and four years' practical experience in foundry and chemical laboratory. At present employed. Address Box 881, THE FOUNDRY, Cleveland, Ohio.

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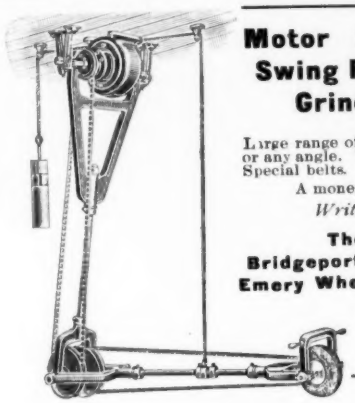
POSITION WANTED BY PRACTICAL MALLEABLE IRON MELTER. Reference furnished. Address Box 858, THE FOUNDRY, Cleveland, Ohio.

FIRST-CLASS BLAST FURNACE OR FOUNDRY CHEMIST open for engagement. Up-to-date on rapid cupola practice. Ten years' practical experience. Capable of taking complete charge of melting department. Address Box 841, THE FOUNDRY, Cleveland, Ohio.



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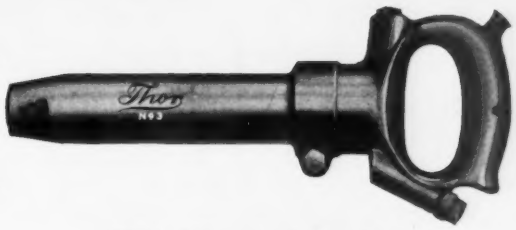

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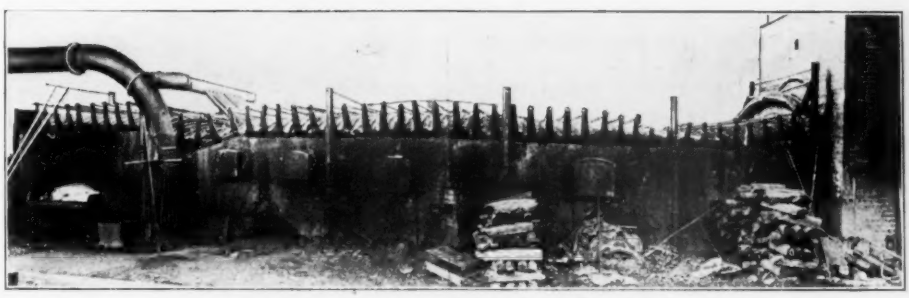

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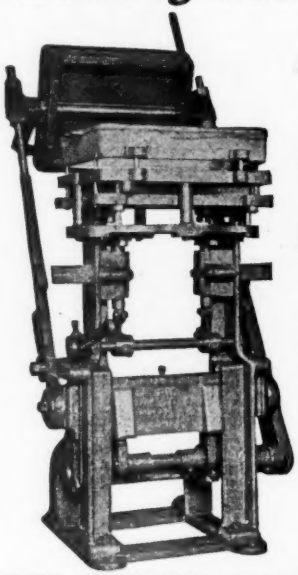

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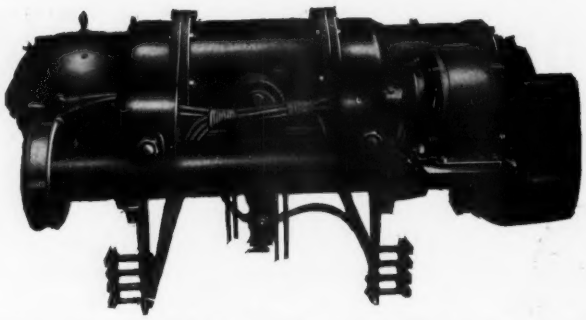

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Then *we* will make up a detailed working plan of your foundry, showing the "MOYER TRAMRAIL SYSTEM" installed.

We will tell you just how it can be installed.

We will tell you what the "*System*" will cost you f. o. b. your city.

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It will cost you very little to send such a plan.

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And we'll call the deal off.

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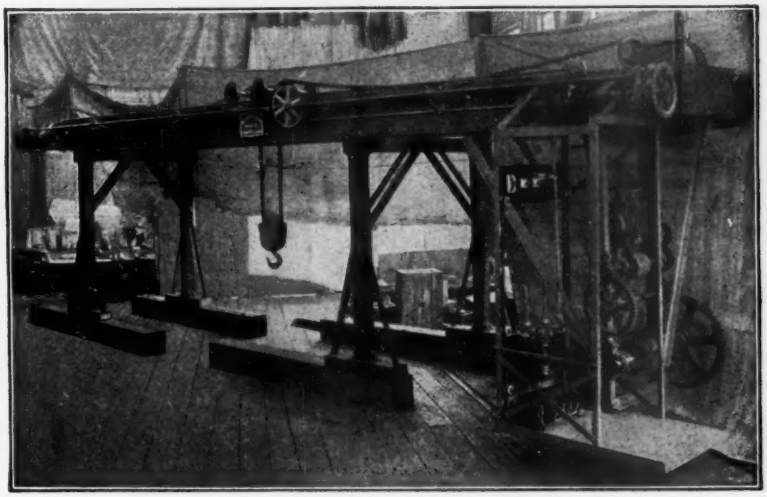

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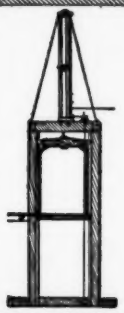

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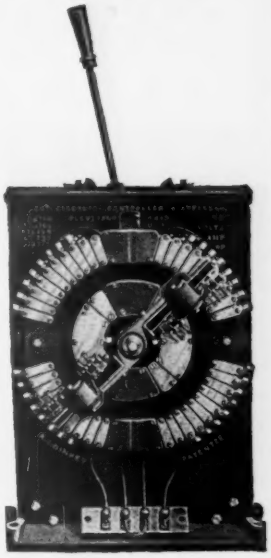

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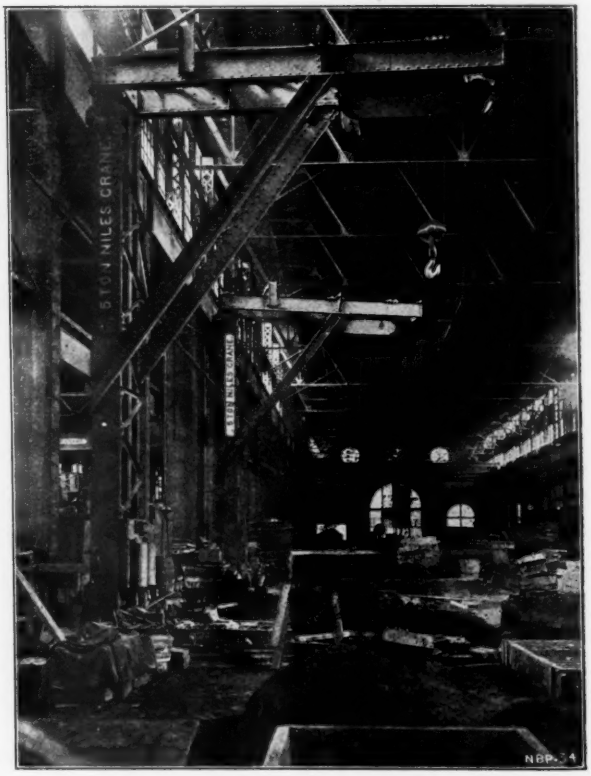

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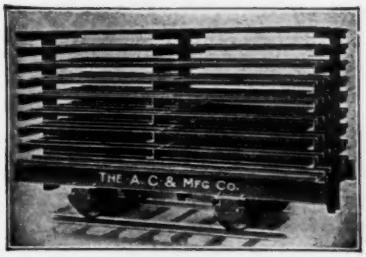

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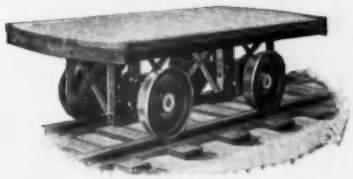

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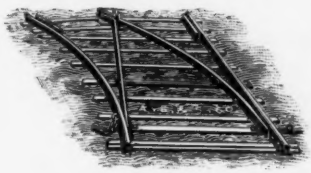

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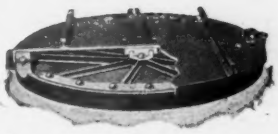

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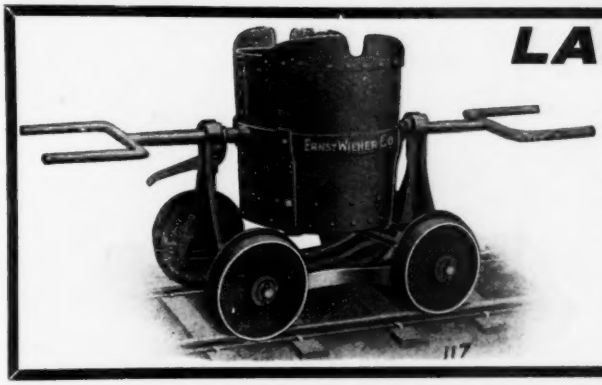

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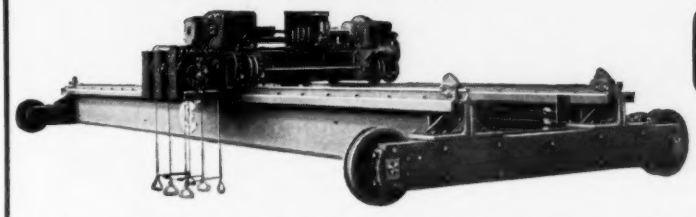


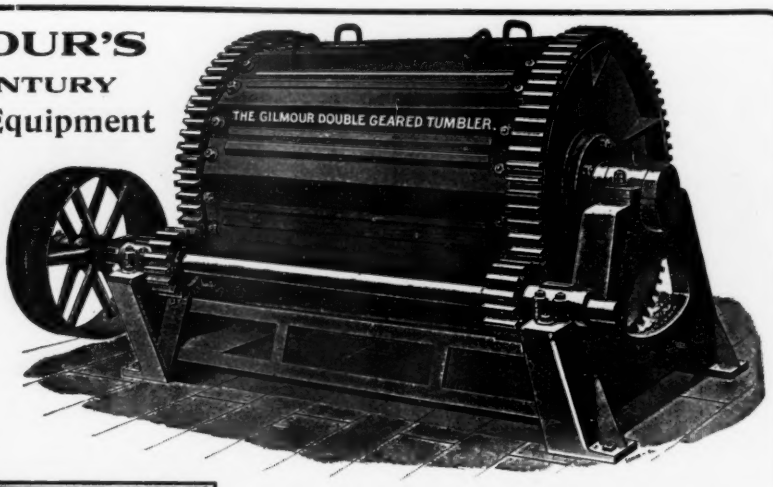
CRANES

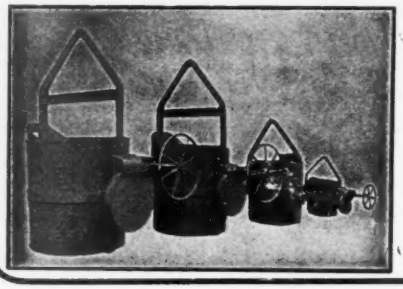
A. C. or D. C.
MOTORS.

THE CASE MFG. CO., COLUMBUS, OHIO.

GILMOUR'S
20th CENTURY
Foundry Equipment

CUPOLAS
TUMBLERS
TRUCKS
CRANES
LADLES





Gilmour's Double Spur-Geared Tumbler

is the longest-lived and most practical mill ever put on the market. Let us tell you more about it.

J. GILMOUR

Bennett Building **New York**

"PARTAMOL"

The Acknowleged Standard Parting for Parting Molds

The Money Saver and Profit Producer

"Success means willingness to put aside the old for something better."

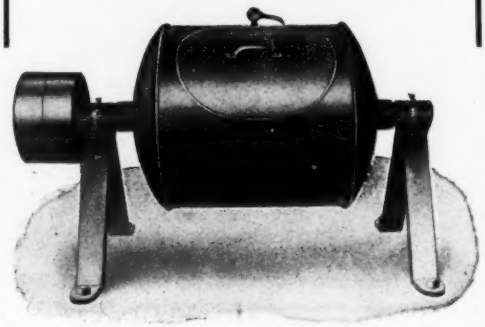
Partamol is the something "best" in parting compounds. It turns out a perfect mold with every line true to pattern. Allows of easy and perfect "slicking" of the mold. The results from its use will astonish you. The price will please you. Sample on request. Ask your jobber or

THE PARTAMOL COMPANY,

605 BROADWAY, NEW YORK.

LIGHT RUNNING

STEEL SHELL TUMBLERS

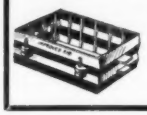


Wet and Dry for Brass and Iron Castings, Stampings, Etc.

Large door instantly opened and closed. Babbitted Bearings with covered oil cups. Complete equipment for modern brass foundry shown in our catalog No. 12

Brass Founders Supply Co.

Flask Specialist



NEWARK, N. J.

PERFECTO

LIQUID CORE COMPOUNDS

GRADED TO SUIT YOUR FOUNDRY CONDITIONS

POSSESSING FOLLOWING STRONG FEATURES

Very Little Gases. Easy Peeling of Core.
Non-Blowing Qualities. Highest Binding Value.

TRIAL SOLICITED

MANUFACTURED BY

FRANK L. YOUNG & KIMBALL

Boston, Mass.

BRANCHES:
CHICAGO NEW YORK PHILADELPHIA NEW BEDFORD LIVERPOOL

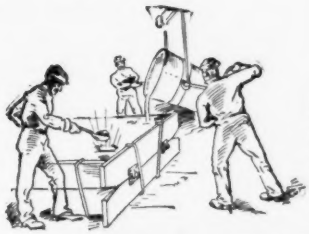
Represented by W. EDWARD BAIRD.

AGENTS FOR CANADA:
HAMILTON FACING MILL CO., Limited; Hamilton, Ont.

"THERMIT"

(Trade Mark Registered.)

helps the expert foundryman to overcome many difficulties hitherto beyond his control. Thermit reaction produces 5400° F. anywhere in half a minute without heat or power from outside, and separates out liquid steel.



THERMIT REVIVES DULL IRON OR STEEL

in ladles or risers preventing cold-shuts and other defects resulting from dull metal. Titan Thermit increases fluidity and assures tough, close-grained castings.

THERMIT REPAIRS FLAWS

in castings and forgings. The intensely hot steel washes out the defective area replacing it with pure steel. Saves much waste.

It will pay you to investigate the manifold uses and advantages of Thermit.

Send for our valuable pamphlets.

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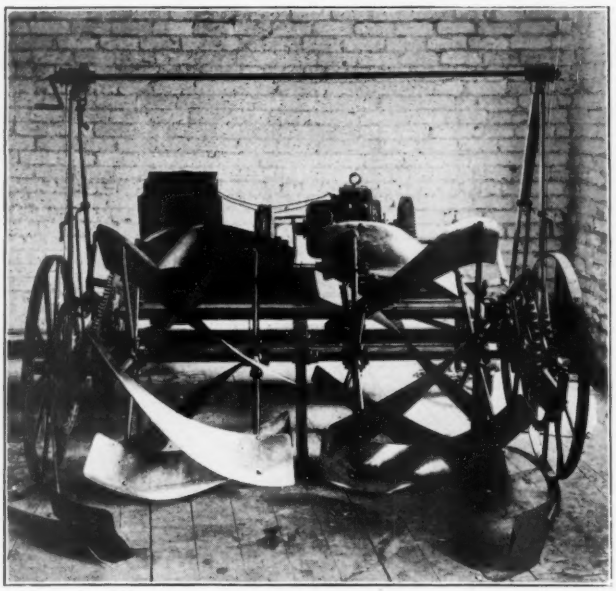


The Stockham Homogeneous

SAND MIXER

A Practical and Economical Cutter.

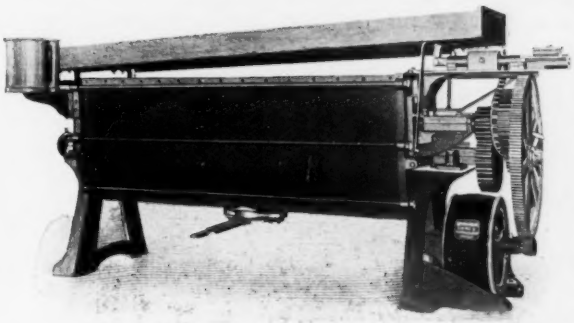
This machine will cut 12 heaps of sand 60 ft. long in one hour—10 heaps 100 ft. long or 8 heaps 150 ft. long in one hour. The machine is simple and self-contained requires but two men and 50 cents worth of power to supply sand for 200 moulders. One cutting is more thorough than four with the hand shovel. Nothing complicated—the inexperienced can operate it in 30 minutes. Descriptive circulars on request.

The Stockham Homogeneous Mixer Mfg. Co.
Piqua, Ohio.

ROCKWELL

Double Chamber Melting Furnaces
Fuel Oil Burning Appliances
Rockwell Engineering Co.
New York

The Standard Sand Mixer and Screen



With or without direct motor attached

thoroughly screens, mixes and tempers sand at a cost for labor of four cents per cubic yard, with a saving of from 40c to 50c per cubic yard, in the cost of the different binders used, besides reducing the discounts of cores 25% to 50%.

Our leading line is Sand Mixing Machinery, plain and automatic, capacity from one to fifteen tons per hour, and equipping foundries with automatic conveying, screening and tempering machinery for preparing sand and delivering to and from Molding Machines. Engineers and Machinists, also shippers of all grades of Molding Sand.

The Standard Sand & Machine Company,
Cleveland, Ohio.

THE DEANE PNEUMATIC SAND SIFTER

An entirely new design of pneumatic or steam shaker for sifting sand wherever compressed air or steam power is available.

The air cylinder is an ingenious application of the engine of the Deane steam pump.

Apparatus is absolutely reliable under all conditions.

The Deane sifter is in every way much superior in construction to any other similar device on the market.

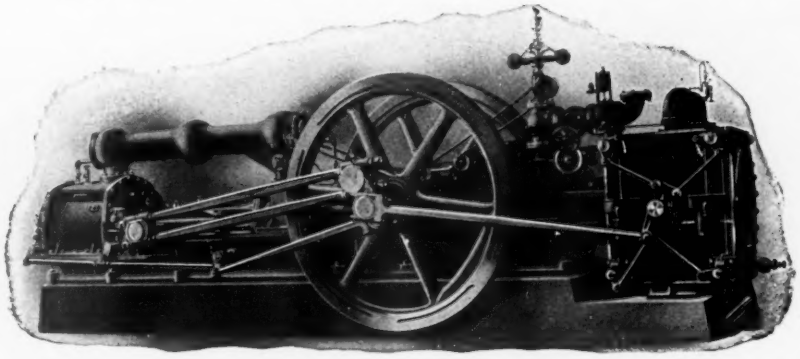
Apparatus is designed to withstand long and hard usage. There is great power with small consumption of air or steam.

Send for Circular.

The Deane Steam Pump Co.
Holyoke, Mass., U. S. A.

You need 100 lbs. air pressure for effective work with the air hammer; you need only about 20 lbs. for the air blast.

What is the sense of compressing all the air to 100 pounds and throttling down or using a pressure reducer for the sand blast, or installing two air compressors?



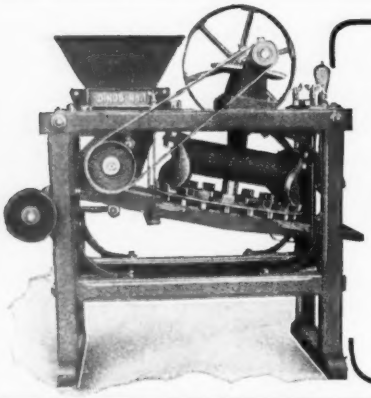
Take the two pressures from the same compressor, in exactly the quantity needed for the varying demands of each pressure.

Save power. Make your compressor more available and effective for each use.

Be ahead of the procession and use the very latest improved machinery.

The AUTOMATIC SKIP VALVE now being introduced by the Norwalk Iron Works Company does the work. Will tell you more about it for the asking.

THE NORWALK IRON WORKS COMPANY,
SOUTH NORWALK, CONN.

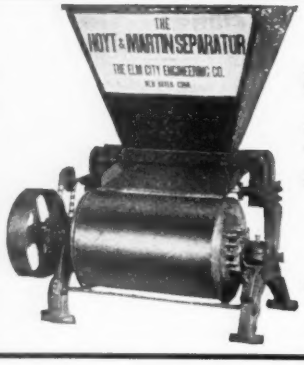


Magnetic Separators

FOR

Iron Foundries, Brass Foundries, Mines, Etc.

Dings Electro-Magnetic Separator Co.
MILWAUKEE, WIS.



Magnetic Separator

If you want the Best Separator made, which will extract iron from brass or any other substance.—Write to us.

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The Adams Snap Flask

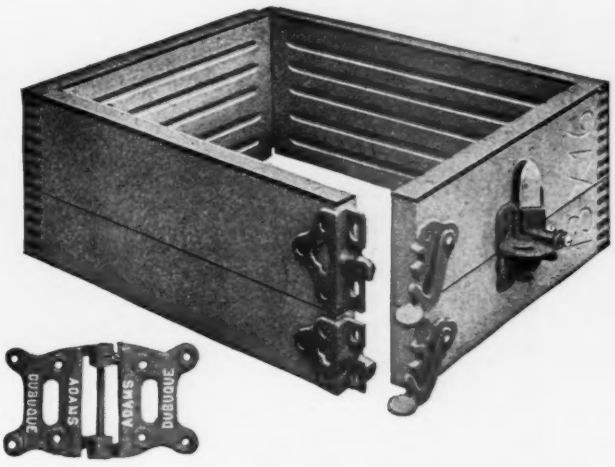
Selected Dry Cherry
1 1-16 inches thick, is used in our flasks which alone costs more than all of the material used in the ordinary flask.

Corners
of the flask are machine locked, giving greater surface for gluing, and a stronger joint than is possible to obtain from a dovetail or mitre.

Trimmings
are of malleable iron. The snaps are without doubt the quickest snaps to operate.

Top Irons
which protect the edges of both cope and drag are ⅛ x 1 inch wrought iron with Welded Corners, which make the flask more rigid.

Pins and Ears
of malleable iron, with ¾ inch milled bearing on each side of the right angle. Fine adjustment in both ears is provided by means of a screw on the ends of the ears. Both ears being adjustable, cope and drag are easily kept in line



THE ADAMS COMPANY

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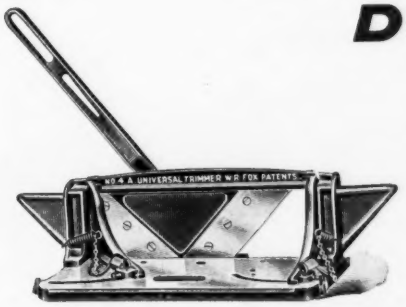


DO YOU KNOW

that 101 times a day the pattern maker uses his hand tools for squaring up and trimming little pieces that he could do in one tenth of the time on a trimmer if it was on his bench like his planes and chisels?

Do you know that if it is in his own exclusive control it will always be sharp like his hand tools.

Do you know that if these machines only save fifteen minutes time for each man each day that they would earn over 100% per annum on the investment and leave a surplus?

FOX MACHINE COMPANY,

Specialists in Complete Pattern Shop Equipment.

850 N. Front St., Grand Rapids, Mich.

WE MANUFACTURE AND MAKE A SPECIALTY OF

FOUNDRY FLASKS

OF ALL KINDS.

Send your orders direct to us. Snap Flasks of all kinds,—straight side, taper, cut and round, right or left hand.

DIAMOND CLAMP & FLASK CO., Richmond, Ind., U.S.A.

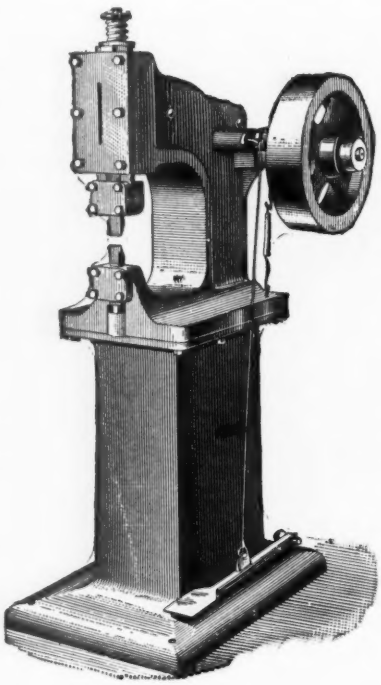
MacKELLAR'S CHARCOAL FACINGS

Cannot be excelled

Pine Charcoal for Stove Plate, Charcoal facing for general foundry use, Brass founders parting charcoal or any other sort desired.

THE PEEKSKILL FACING MILLS
Estab. 1844 Incorp. 1902

Address: R. MacKellar's Sons Co.
Peekskill, N. Y.



Don't Hesitate

to invest in whatever saves labor.
Every blow of the hammer on the chisel in the old chip, chipping away way of cutting gates from castings, trims down the margin of profit.

A Shuster
Power or Foot Lever
Sprue Cutter

operated by one man will do more than a dozen men can in the hammer and chisel way and the castings will be trimmed cleaner and closer.
We make a specialty of building automatic labor saving machinery.

Catalogue for the asking.

F. B. Shuster Co.

Formerly John Adt & Son.
New Haven, Conn.

BURDICK & SON

Manufacturers of

Patent Stove Dovetails,
Hinge Tubes,
Door Catches,

Cover Lips,
Core Chaplets,
Screw Shells, Etc.

Send for samples and prices to
ALBANY, N. Y.

THE MIDDLEDITCH
SPRUE CUTTER

Trims the castings so clean and close they seldom need grinding. It does the work of many men with hammer and chisel—and does it better—there is economy in its operation. The machine is heavy, fitted with a very simple clutch, large wearing parts of tool steel, will cut a piece equivalent to ¾" of square brass.

You cannot safely disregard improved methods, because of the seeming success of the old.

Ask us to prove it.

Tilting Tumbling Barrels
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Brass Molders & Molding Machine Flasks,
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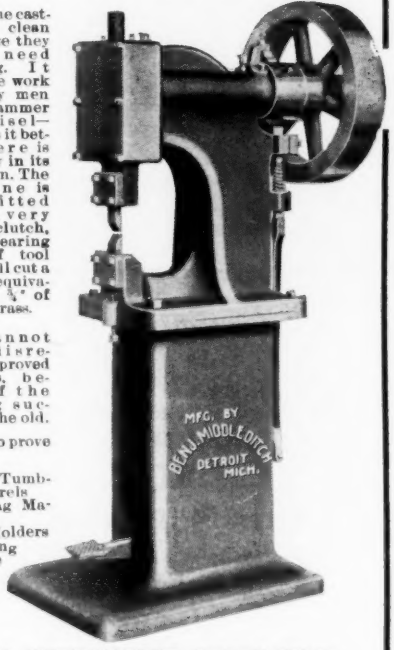
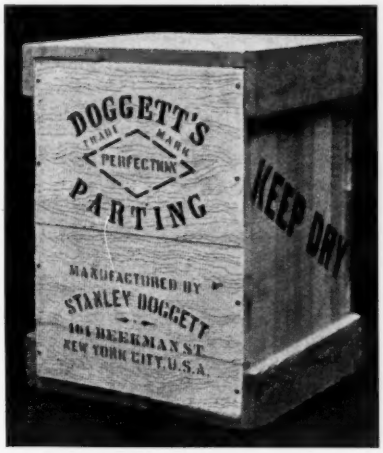
etc.



BENJ. MIDDLEDITCH, Detroit, Mich.

FOR PERFECT PARTINGS
ACCEPT NO OTHER
SEE TRADE MARK



Suitable for Bronze, Brass or Any Other Metal

Working Samples Sent Free Upon Request.

FAR SUPERIOR TO

Lycopodium---Charcoal---Charcoal Facings

FOR Straight and Difficult lifts. Sticky Patterns, Slanting Copes and Deep Chasings

Perfect Partings

MEAN

SHARPER CASTINGS SMOOTHER SURFACES
PERFECT CORNERS EASIER LIFTS

Doggett's Parting

PERMITS

Swabbing and Slicking—Will not burn off the face of the mould, wash or cut.

Manufactured by

STANLEY DOGGETT
101 Beekman St.,
NEW YORK CITY, U. S. A.

Partine
THE UNIVERSAL PARTING

Preferred by Leading Foundrymen to Lycopodium.

Partine does not run, cut, wash or burn off the face of the mould.

Guaranteed to produce, in every instance, a PATTERN TRUE casting, displaying the most delicate lines and features of an artistic design, accompanied by an absolute smoothness of the edges of the metal.

Its price is so low as to make its use imperative in every modern foundry

Write for free sample, descriptive booklet and full particulars.

Cable Address: PARTINE **The Foundry Specialty Co., Cincinnati, O., U.S.A.**

LUBRICATING FLAKE GRAPHITE

FOR ALL PURPOSES

POWDER GRAPHITE, PLUMBAGO and BLACK LEAD

For All Foundry Requirements Large Samples On Application

UNITED STATES GRAPHITE CO.
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PHILADELPHIA, PA.

Mines, Byers Station, Chester County, Pa.

WE BREAK STRIKES! Also handle labor troubles in all their phases. We are prepared to place secret operatives who are skilled mechanics in any shop, mill or factory, to discover whether organizing is being done, material wasted or stolen, negligence on part of employes, etc.

We guard property during strikes, employ non-union men to fill places of strikers, fit up and maintain boarding houses for them, etc. Branches in all parts of the country. Write us for references and terms.

THE JOY DETECTIVE SERVICE

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A Molders Bellows will wear for 20 years with care or 10 years without care. We have proved it—but it has to be a good bellows—A SOPER. The Soper is the best. We have sold it for 30 years. Now we make it and sell it.

Sample sent on approval.
Established 1844.

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Desirable Foundry Locations

Note these very attractive openings for foundries and machine shops:

A thriving small city of Arkansas in the timber district. Much repair work for general woodworking plants adjacent.

A Texas city of 8,000 has no machine repair shop. Also none within wide radius.

A large Nebraska city offers many advantages for up-to-date foundry and machine shop.

Each of these are along the lines of the

ROCK ISLAND---FRISCO LINES

Full particulars concerning these excellent openings, besides many similar ones existing along our lines will be furnished upon application.

Send for book "Opportunities" and other literature.

M. SCHULTER, Frisco Bldg., St. Louis, Mo.
Industrial Commissioner, Rock Island-Frisco Lines.

Dye's Special MOLDING SAND

The strongest fine sand on the market, thoroughly disintegrated by means of our new Plant at the Mines, is not only superior for Malleable, Grey Iron and Brass, but on account of strength, the CHEAPEST.

The Newport Sand Bank Co.
Newport, Ky., U. S. A.

Albany Sand

All Grades of the famous Albany Sand, carefully Selected and Graded.

Order direct from Albany.

Albany & North River Molding Sand Co.
ALBANY, N. Y.
Producers and Shippers of the World's Best Molding Sand.

YOUR **MOLDERS** SHOULD BE AS WELL EQUIPPED WITH **TOOLS** AS YOUR FOUNDRY

HELP THEM SECURE OURS

WILLIAM DOBSON
Maker of Molders' Tools.
Elm and Spencer Sts., CANASTOTA, N. Y.

OTIS STEEL

"Otis" Fire Box Plates a Specialty

FLANGE PLATES, SHIP PLATES, TANK PLATES, STEEL CAR AXLES, AND FORGINGS OF ALL KINDS

Steel Castings from 100 to 100,000 lb.

Head Office and Works, CLEVELAND, O.

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DETROIT, George W. House, Union Trust Building.
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TUMBLERS
TURNTABLES

Complete Foundry Equipment, Cupola Linings

Pridmore Molding Machines. Dings Magnetic Separators.

EDWARD J. ETTING, HARRISON BLDG., PHILADELPHIA.

HARBISON-WALKER REFRACTORIES CO.
PITTSBURGH, PA.

Manufacturers of Highest Grade Refractories.
Importers of Chrome Ore.
Sole Agents for Carl Spaeter Magnesite.

Fire Clay, Silica, Magnesia, Chrome

BRICK.

Cupola Linings a Specialty.

7,500 Regular Customers. *Write for Booklet F.* 1,100,000 Daily Capacity.

SANITARY WASH BOWLS

Clean, compact and practical. Individual galvanized or enameled metal bowls. Single or double batteries. Complete equipments ready to connect with cold, tempered or hot and cold water supply.

You cannot afford to make or use former utilities of this nature in comparison with this strictly up-to-date device.

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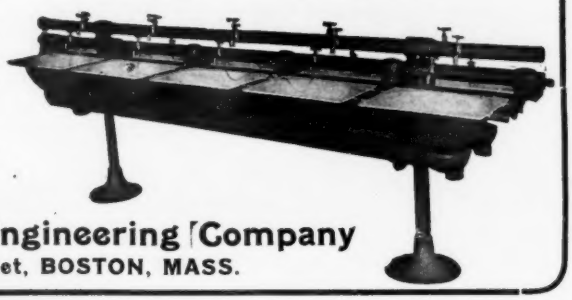
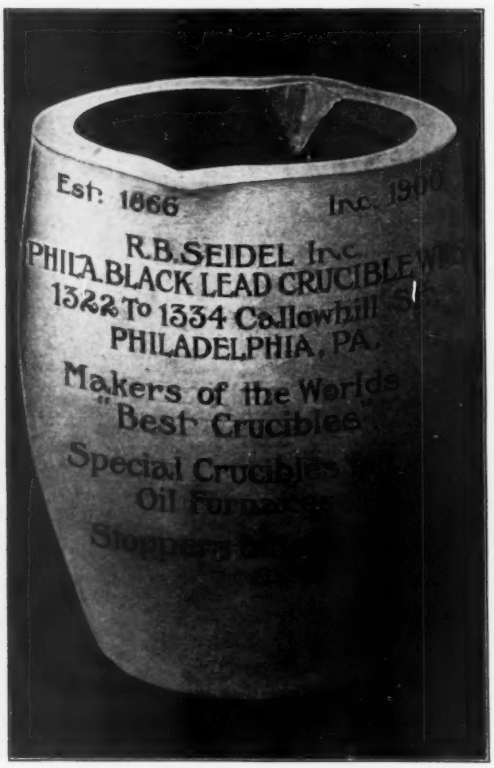


Mfg. Equipment & Engineering Company
209 Washington Street, BOSTON, MASS.



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the Buyers' Directory on pages 124, 126, 128 and 130 of this issue. Therein you will find people most to be desired in a business transaction.

THE SURPLUS COKE CO.

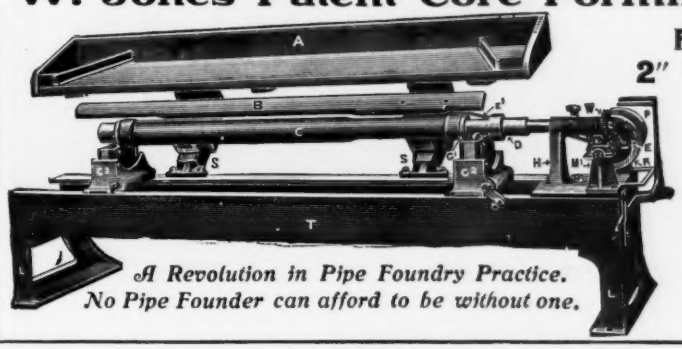
Best Connellsville Brands

"The Coke of Quality"

Write for prices

1 Madison Ave. **NEW YORK CITY**

W. Jones Patent Core Forming Machine



A Revolution in Pipe Foundry Practice.
No Pipe Founder can afford to be without one.

For Pipe Cores 2″ to 20″ diameter.

MANUFACTURED BY

Jones & Attwood

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JEL-O-LUSE

Makes cores with either burnt, waste sand or new.
Rids the foundry of smoke, odor and gas.
Saves castings. Saves lungs.
Saves time in cleaning cores from castings.
Superior results with economy covered.

A long list of most reliable firms daily put Jeloluse to practical use proving its SUPERIORITY AND DESIRABILITY.

Evidence of above facts await you.
Goods put up in bbls. of 250 and 175 pounds BUT, as few pounds as desired furnished as trial order.

NAT'L JELOLUSE CO., 547 West 43rd St. NEW YORK.

N. B. We can meet competition in furnishing a good core flour where same is desired.

£ Oil is the base of all successful core compounds. In

STERLING CORE OIL

is found the most economical material for making good free venting cores.

STERLING OIL CO., Emlenton, Pa.

Original and Genuine

Keystone Foundry Flux is the flux that all others have to give way to

No conditions that we cannot extricate you from if you are in trouble in your Foundry. If you are resting serene upon supposed perfection, then we can advance you 10% or more. At our expense entirely we will prove by demonstration the following and all we ask on your part is friendly co-operation by persons in charge. Shorten your heats from 10 to 60 minutes. Increase cupola capacity 50% and upwards Any kind of foundry coke used. By-product or other wise, and save from 10 to 30% in coke. Make a very much hotter iron which will be extremely fluid and absolutely clean and stand Government tests Scarcely any shot iron left. Puts new life in iron and a greater quantity of scrap can be used, iron actually from 10% to 20% softer (when Thermit brand is used). There will be much less shrinkage. Short running or cold shuts are entirely done away with. Ladles keep clean, and makes cupola drop clean. Do not have ⅓ the slag. Cupola picks out easier and bricks last much longer. We have different brands for every variety of foundry practice. Banish your prejudices and write us. Many of the best foundries in the country are our customers. Equally as beneficial for various kinds of cast iron, makes semi steel uniform. Remember we stand all expense to responsible parties and will demonstrate free where heats are large. Don't confound us with any other flux manufacturers. We have no associates or alliances. Our goods stand on their merits and we will do all we advertise. We own and control all the mines producing twenty or more minerals used in the manufacture of the different brands of Keystone Flux. Beware of attempted imitators. *Don't class us with fakes.* Send for circular, also references of actual users of every branch of foundry practice. Send for trial barrel free. First come first served.

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Money Saving Books on Foundry Practice

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NOW THE RECOGNIZED
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The Fact that the United States Government has awarded us a contract for 600,000 lbs. —the largest order ever placed—is sufficient evidence of the character of our product.

Sold in Ingots and Castings by

THE AJAX METAL COMPANY

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The perfect softening alloy for Cast Iron. Used in the ladle.

TRADE MARK

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Softens, Strengthens, Improves grain and tooling quality. Eliminates Sulphur. Prevents blow-holes.

Order direct and avoid Substitution.

MIDVALE MINING & MFG. CO.

SOLE MANUFACTURERS, **East St. Louis, Ills.**

Ferre-Manganese (80%)

Ferro-Silicon (50% & 75%)

Lump, pea-size, and ground
In kegs and casks.
Quick shipment.

MIDVALE MINING & MFG. CO.,
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Originator of Metallic Fluxes for grey iron.

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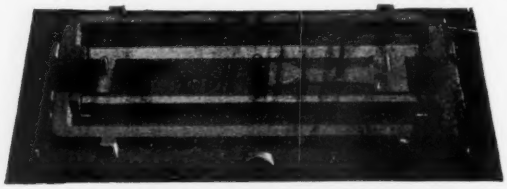

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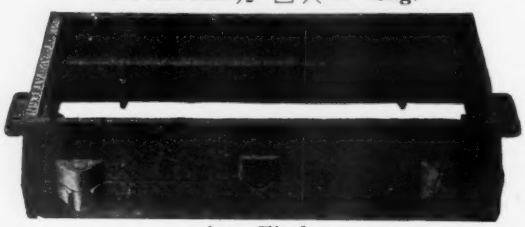

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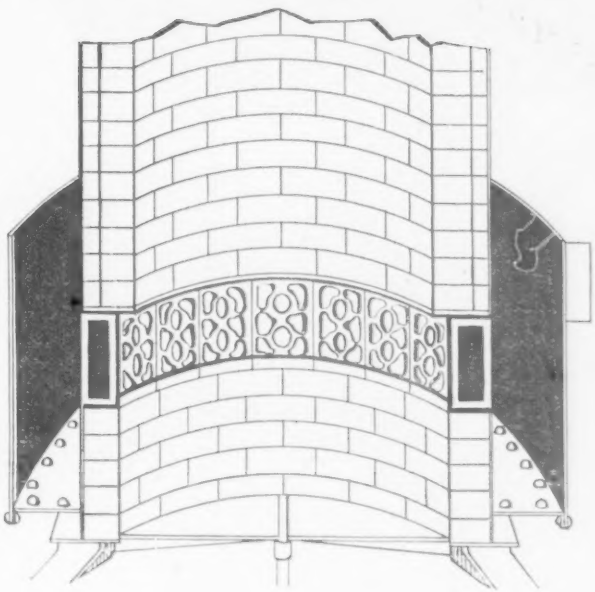

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